



PRELIMINARY ASSESSMENT

S. BROADWAY AND BELLEVIEW PCE

ARAPAHOE COUNTY, COLORADO

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PRELIMINARY ASSESSMENT, FIRST REVISION

**BROADWAY AND BELLEVIEW PCE
ARAPAHOE COUNTY, COLORADO**

**COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION**

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PRELIMINARY ASSESSMENT, FIRST REVISION

BROADWAY AND BELLEVIEW PCE ARAPAHOE COUNTY, COLORADO

1.0 INTRODUCTION

This Preliminary Assessment (PA) of the Broadway and Belleview tetrachloroethene or perchloroethylene (PCE) contamination site (CERCLIS CO 0001104264), which is centered at 5100 South Broadway in Englewood, Colorado, is prepared to satisfy the requirements as set forth in a cooperative agreement between the U.S. Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division (CDPHE).

A preliminary site investigation for the Colorado Department of Transportation (CDOT) indicated that the ground water beneath the South Broadway/Belleview intersection area has been impacted with chlorinated volatile organic compounds (VOC) (Industrial Compliance, April 27, 1995). The currently inactive Brookridge Amoco (Amoco) service station, which is on the southeast corner of the intersection, is located above the center of the known ground water contamination in the area.

This report is based on the search and review of information relating to the site including CDPHE PA/SI, Solid Waste and the State Oil Inspection UST files, and recent environmental investigations relating to the Amoco/Chevron service station at 5100 South Broadway, particularly on the studies conducted by Industrial Compliance in connection with the plans of the Colorado Department of Transportation (CDOT) to widen the South Broadway/Belleview intersection.

This preliminary assessment reports on the site history, waste characteristics and preliminary pathway analysis.

2.0 OBJECTIVES

The objectives of this PA are to:

- (1) identify and characterize on-site waste;
- (2) assess the potential for contaminant migration; and
- (3) determine the potential impacts to human health and the environment.

3.0 SITE DESCRIPTION

3.1 Location

The site is a contaminated ground water plume beneath a commercial zone in the vicinity of the South Broadway/Bellevue intersection in Englewood, Arapahoe County, Colorado. Using the inactive Amoco service station, 5100 South Broadway, as a reference point, the site is situated in the Northeast 1/4 of Section 15, Township 3 South, Range 68 West with the coordinates of 39 degrees, 37 minutes, 26 seconds North Latitude and 104 degrees, 59 minutes, 14 seconds West Longitude.

From the Colorado Capitol in Denver, the site is 7.75 miles south to the reference point (inactive Amoco service station) at the southeast corner of the South Broadway/Bellevue intersection. The Amoco service station itself is about 1/3 acre composed of two pump islands, the station building, concrete and/or asphalt-paved sidewalks, driveways and parking. Active business establishments within the site area include Black Eyed Pea Restaurant, portions of Brookridge Shopping Center, Eskimo Ski Shop, Water Leisure, Star Dry Cleaning, Tune Shop, Vectra Bank, World Savings Bank, Jet Wash, Grease Monkey and Meineke Muffler (Figure 4).

3.2 Site History

The actual sources of VOC contamination in the site's ground water are not fully determined. While analytical results indicate the presence of acetone, benzene, chloromethane, tetrachloroethene (PCE), trichloroethene (TCE), 1,2-dichloroethane (1,2-DCA) and cis 1,2-dichloroethane (cis 1,2-DCA) in the ground water beneath the Amoco property, there are other possible contamination sources that existed or are presently active in the site area (Industrial Compliance, 1995). The VOC's that were detected in the ground water at the site are commonly used in service stations and automotive repair shops for parts washing or degreasing and brake cleaning (CDPHE Waste Assessments on Vehicle Repairs and Maintenance: Denver Public Works Fleet Maintenance, and others, 1992-1994 CDPHE Waste Assessments). PCE is the primary cleaning solvent in dry cleaning plants.

From historic property records (Industrial Compliance, Initial Site Assessment, Intersection of South Broadway and Bellevue Avenue, 1994 or Industrial Compliance, 1994), the site includes the following businesses which may have potentially contributed to the chlorinated VOC contamination of ground water at the site:

..5100 South Broadway (southeast corner of South Broadway/Bellevue intersection) is the site of the currently inactive Brookridge Amoco service station. This was formerly Brookridge Chevron Service Station No. 7-0036 which operated from 1951 to 1990 and then was taken over by Amoco Oil. This is the focus of Industrial Compliance's Preliminary Site Investigation, dated April 27, 1995, for the Colorado Department of Transportation (Industrial Compliance, 1995).

..5090 South Broadway (northeast corner of South Broadway/Bellevue intersection) is the current site for Tune Shop (not listed as RCRA notifier). Precision Tune and Mountain States Tune Up operated at the same facility from 1980 to 1990. Bellevue Conoco and Alway Conoco Service started and operated at the facility from 1960 to 1980.

..73 East Bellevue Avenue is a dry cleaning plant which is currently operated by Star Cleaners since 1990. Country Club Cleaners operated the facility from 1980 to 1985. From 1970 to 1975, Your Valet Cleaners operated this same facility which was started and operated by One Hour Martinizing from 1958 to 1965.

..5085 South Broadway (north and adjacent to northwest corner of South Broadway/Bellevue intersection) was home to Skelly Service station known as Bill Crouch Skelly during the years 1970-1975; Leroy's Garage and Skelly Service in 1965, and as Skyline Skelly Service from 1955-1960. Recently, two small UST's of undetermined content were discovered and dug out at the front of the World Savings Bank (Carter).

..5101 South Broadway (southwest corner of South Broadway/Bellevue intersection) has been occupied by Meineke Mufflers since 1993. House of Mufflers operated the facility during the years 1980-1990. Tuff Service Center operated at the facility during 1975 after Broadway Enco Service had occupied the facility from 1965-1970. Broadway Bellevue Carter Service started and operated the service station in this corner from 1955-1960.

Review of available records indicate Amoco as a RCRA C small quantity generator (Listed F002 Hazardous Waste), an UST site, and a LUST site. In 1990, Sierra Environmental Services, Subsurface Investigation Report dated September 1, 1990, prepared for Chevron USA (Sierra, 1990) indicated elevated concentrations of benzene, toluene, ethyl benzene and xylene (BTEX) and Total Petroleum Hydrocarbons (TPH) in the soil and ground water samples from various wells at the Amoco property. A subsequent report, Delta Environmental Consultants, Subsurface Investigation Report, dated December 22, 1993, prepared for Chevron USA (Delta, 1993) details the installation and operation of a soil vapor extraction system (VES) on the southern portion of the property.

3.2.1 Previous investigations

Recent environmental studies and/or data that relate to the Broadway and Bellevue PCE site include Industrial Compliance, 1995 and Industrial Compliance, 1994 prepared for the Colorado Department of Transportation. Industrial Compliance, 1995, established the presence of chlorinated VOC contaminants in ground water but did not identify the source or sources of the contaminants. The study concluded that additional soils and ground water sampling data are necessary in the vicinity of the South Broadway/Bellevue intersection to determine the actual source or sources of the VOC's detected in the bedrock ground water at the site.

Environmental studies that are specific to the Amoco service station include Sierra 1990 and Delta Environmental Consultants, Subsurface Investigation Report, dated December 22, 1993 (Delta, 1993) prepared for Chevron USA.

There is no record of hazardous waste management practices or analytical data which indicate the various existing and past businesses have contributed to the chlorinated VOC impacts within the entire site area.

3.3 Site Characteristics

3.3.1 Site Topography and Surrounding Land Use

The Broadway and Belleview PCE area is in a complex of public improvements and business establishments around the South Broadway/Belleview intersection. Topography across the site has been modified by building structures and the paved and/or asphalted streets, sidewalks and parking lots. The site is at an average elevation of 5420 feet above mean sea level.

Beyond the commercial zone site area, land use within one mile is generally residential on the west, north and east sides. The south side along South Broadway is predominantly commercial and industrial.

3.3.2 Geology

The site is located on the western flank of the Denver Basin which, at this location, consists of the Denver, Arapahoe and the Laramie-Fox Hills Formations (Figure 3). It is situated on the surficial deposits in the Platte River Valley consisting of Quaternary sediments of eolian sand and loess of Holocene and Pleistocene age. These deposits are 10-30 feet thick (Shroba, 1980).

The bedrock in the area is the Denver Formation. The upper Denver Formation is 300 to 1400 feet thick consisting of shale and claystone. The lower Denver Formation is 400 to 1400 feet thick which is made up of arkosic sandstone and conglomerates (Robson, 1983).

3.3.3 Hydrogeology

There are two principal water aquifer systems in the site area: the South Platte alluvial aquifer system and the Denver Basin bedrock aquifer system (Denver, Arapahoe and Laramie-Fox Hills). The South Platte alluvial aquifer has 1,100 million gallons per day (MGD) withdrawn for agricultural supply and numerous public supply systems and private wells. The Denver Basin system has 30 MGD withdrawn for public supply, rural-domestic and commercial use (Robson, 1987).

From monitoring wells installed at the Amoco property (reference point of site area), ground water elevation or water level is at 29 to 30 feet below grade. Water bearing zones in these wells range from moderate to high permeability sands to low permeability claystone (Sierra, 1990). The Denver Formation, the uppermost bedrock aquifer in the study area, has high proportions of shale and claystone. Hydraulic conductivity in the aquifer ranges from 0.5 to 1.5 feet per day (Robson, 1987). Generalized direction of shallow ground water flow in the site area is north-northwest (Industrial Compliance, 1995).

3.3.4 Hydrology

Regionally, the Broadway and Belleview PCE site is located within the South Platte River drainage basin. Big Dry Creek, which is about 1000 feet south-southwest of the site, is the closest stream. It is a perennial stream with an estimated average flow of 20 cubic feet per second (cfs). Big Dry Creek flows to the northwest until it joins the northeast-flowing South Platte River about 1 1/2 downstream-miles from the site. The South Platte River at this segment is classified as Class 2 Warm-water Aquatic Life and Class 2 Recreational by the CDPHE Water Quality Commission. The South Platte River is hydraulically connected with the alluvial aquifer and thus greatly influences ground water levels (CDPHE, 1994).

The Broadway and Belleview PCE site is outside the 100-year flood plain for Big Dry Creek (McCain and Hotchkiss, 1975). The mean annual precipitation in the site area is 16 inches with a net precipitation of 3.9 inches and a 2-year, 24 hour rainfall of 1.5 inches (Ecology, 1995).

4.0 PRELIMINARY PATHWAY ANALYSIS

4.1 Source Characterization

Chlorinated VOC contaminants in the ground water underneath the South Broadway/Bellevue intersection include Tetrachloroethene (PCE), Trichloroethene (TCE) and 1,2-Dichloroethane (1,2-DCA) (Industrial Compliance, 1995 and Table 2). Concentrations of PCE, TCE and 1,2-DCA were above Colorado Ground Water Standards (CGWS) for these substances (Industrial Compliance, 1995). CGWS for the above substances are equal to the maximum contaminant levels (MCL's), except for 1,2-DCA which has an indicated CGWS of 0.4 parts per billion (ppb) versus a 5 ppb MCL (USEPA drinking water standards). PCE (5 ppb MCL) was detected in water samples from 7 of 13 monitoring wells with concentrations ranging from 20 to 2400 ppb. At these levels of concentrations, PCE could be migrating laterally with or against prevailing ground water flow direction (Avramenko). TCE (5 ppb MCL) was detected in 3 of 13 wells with concentrations ranging from 12 to 25 ppb; and 1,2-DCA was detected in 3 of 13 wells with concentrations ranging from 1 to 54 ppb. The results of soil and ground water organic and priority pollutant metals sampling at the site are summarized in Tables 1, 1a, 2 and 2a (Also, see Appendix 5 for details of site investigation and maps of the sampling wells and boreholes).

Although the chlorinated VOC contaminants in ground water were detected from an analytical subsurface investigation that focused on the Amoco service station, it is not certain that past operations at this property were the only source of the ground water VOC contaminants at the site. It is possible that both past and present operations that use PCE, TCE, 1,2-DCA or products that contain hazardous VOC's in the vicinity of the South Broadway/Bellevue intersection have adversely impacted the ground water at the site. These would include past and present service stations, automotive repair shops and dry cleaning plants. There is no record to indicate that past businesses at the site had spilled or improperly disposed of hazardous wastes at the site. However, in the absence of strict regulation of hazardous waste practices in service stations/automotive repair and dry cleaning shops before the 1970's, it is possible that these operations had inadvertently disposed of hazardous wastes on the ground, sewer and stormwater lines that were then in existence at the site.

According to the Superfund Chemical Data Matrix (SCDM), PCE, TCE and 1,2-DCA are shown to have relatively low toxicity. PCE and TCE are not as mobile in ground water as 1,2-DCA which is shown

to have high mobility. All three substances are highly persistent in lakes. They are shown as having relatively low tendency to bioaccumulate in both the food chain and environment. All have indicated drinking water MCL's of 5 ppb. They are highly mobile in air.

4.2 On-Site Pathway

The risk posed by the VOC-contaminated ground water to human health or the environment via the on-site pathway is considered very minimal. While there may be 60-90 people working in the commercial establishments around the reference center of the site (Amoco service station at 5100 South Broadway), there is no one living on-site. The site is beneath a commercial zone consisting of buildings and concrete or asphalt-paved streets, sidewalks and parking lots.

4.2 Air Pathway

There is no potential impact of the VOC-contaminated ground water to the air pathway. This is further minimized by the fact that there is no one living on-site nor within 200 feet of the site perimeter. Since the VOC contaminants are in the ground water, volatilization is probably insignificant.

A review of the 1990 U.S. Census data reveals the following population distribution within a four-mile radius of the site (Wendt and Rolka, 1994).

<u>DISTANCE (Miles)</u>	<u>POPULATION</u>	
On-Site	0	60 - 90 workers
0 - 1/4	913	
1/4 - 1/2	3154	
1/2 - 1	10,535	
1 - 2	24,163	
2 - 3	45,987	
3 - 4	67,799	

4.4 Ground Water Pathway

Ascertaining the sources of VOC contaminants in the ground water and determining the extent and possible adverse environmental impact of such contamination remain as the major unresolved issues of the Broadway and Belleview PCE study. The presence of VOC's such as acetone, benzene, chloromethane, PCE, TCE, 1,2-DCA and cis 1,2-Dichloroethane (cis 1,2-DCA) in the ground water has been established (Industrial Compliance, 1995). With the elevation of the site being about 100 feet higher than the point (1 1/2 miles northwest of site) where the Big Dry Creek joins the South Platte River (Figure 2) it is possible these contaminants could be released to downstream surface water via the ground water.

According to the State Engineer's well permit data base, there are about 593 domestic and 47 municipal wells identified within the 4-mile radius area around the site (Figure 5). All the domestic wells, except about 20 wells, were installed before 1980. Most likely, the 573 pre-1980 wells are inactive or abandoned because they have been replaced with direct connections to municipal drinking water supplies provided by Denver Water and the City of Englewood. Of the 47 municipal wells, 27 have been verified as abandoned wells by the cities of Englewood and Littleton (McCormick and Culligan). The remaining 20 municipal wells, which are upgradient southeast of the site and located within the 2-3 and 3-4 mile areas, belong to small semi-public or private drinking water districts such as the Holly Mutual Water District, the Greenwood Plaza Water District and others. Except for the population segments served by these small drinking water districts and about 20 newer domestic wells, the entire population within the 4-mile radius area of the site is served by Denver Water and the City of Englewood, both of which depend solely on surface water for drinking water supplies. There are no active domestic or municipal wells that are identified within the 1/2-mile radius area around the site. For these reasons, no domestic or municipal well is considered as a primary target.

The 20 newer domestic wells, which are upgradient and located southwest of the site within the 2-3 and 3-4 mile areas, may be active (Bock). Assuming a domestic well serves an average of 2.4 persons, the 20 newer domestic wells serve 48 people. According to the CDPHE Inventory of Public Water Supplies, the Holly Mutual Water District serves about 175 people and the Greenwood Plaza Water District serves about 1000 people.

4.5 Surface Water Pathway

The natural drainage direction of surface water runoff from the site would be south-southwest towards Big Dry Creek. But with all the improvements at the site, surface water runoffs are directed into the existing stormwater gutter system at the South Broadway/Bellevue intersection. These runoffs should not pose any threat to human health or the environment.

The City of Englewood Water System currently maintains two surface water intakes for drinking water within 1 1/2 downstream-miles of the site. The major water intake facility is located on the South Platte River at Union Avenue and produces about 80% of the system's annual requirement of 2.7 billion gallons of raw water. The smaller intake, which supplies 20% of the annual raw water requirement, is on the City Ditch at Layton Avenue. These two intakes are connected into a central filtration and treatment plant located at Layton Avenue and Windermere Street. These facilities are about 400 feet north of the Big Dry Creek channel and about 1 downstream-mile from the site. The City of Englewood Water System serves 30,000 people.

The Broadway and Bellevue PCE site is outside the 100-year flood plain for Big Dry Creek (Figure 6). Fish population in Big Dry Creek is unknown. Fish population in the South Platte River is estimated at 130 pounds per acre consisting mainly of bass, chub, walleye, bluegill and carp. Bald eagles, peregrine falcons, black-footed ferrets, whooping cranes, Eskimo curlews, and Mexican spotted owls are endangered species that may be present within 15 downstream-miles of the site. Also present in this same segment might be some Federally designated candidate species such as the white-faced ibis, Baird's sparrow, the Loggerhead shrike, Preble's meadow jumping mouse and Swift fox (Ecology, 1995). Sensitive environments within the 15 downstream-miles segment include riverine and palustrine wetlands associated with the Big Dry Creek and South Platte River (U.S. Dept. of Interior National Wetlands Inventory).

5.0 SUMMARY AND CONCLUSIONS

Recent subsurface investigations in the area of the South Broadway/Bellevue intersection indicate acetone, benzene, chloromethane, PCE, TCE, 1,2-DCA and cis 1,2-DCA are present in the ground

water. Detected concentrations of PCE, TCE and 1,2-DCA were above the Colorado Ground Water Standards and the MCL's for these substances. The sources of these chlorinated VOC contaminants are not determined. Aside from the Amoco service station, there are other present and past operations in the area which have potentially contributed to the VOC contamination in the ground water, including automobile maintenance shops and dry cleaners. With extensive past automobile service and maintenance and dry cleaning activities at the site, it is possible that VOC contamination in ground water could be more widespread than what is already known. There is no active domestic or municipal well within the 1/2-mile radius area of the site.

The risk posed by VOC contaminated ground water to the air and on-site pathways is considered minimal. There is no one living on-site nor within 200 feet of the site perimeter, though there are 4067 people living within the 1/2-mile radius area of the site.

The VOC-contaminated ground water may impact downstream surface waters, fishery and wetlands in the Big Dry Creek and South Platte River. The adverse effect of such impact may be insignificant, however, since VOC's are not generally long-lived at the surface, and as indicated do not readily bioaccumulate in the food chain and environment.

The City of Englewood maintains two surface water intakes for its drinking water supplies within 1 1/2 downstream-miles from the site. The site is outside the 100-year flood plain for the Big Dry Creek. Fish populations are present in the South Platte River. Endangered species such as bald eagles and peregrine falcons may be present within the 15 downstream-miles along with Federally designated candidate species such as the white-faced ibis or Baird's sparrow. Sensitive environment within the 15 downstream-miles from the site include riverine and palustrine wetlands associated with the Big Dry Creek and the South Platte River.

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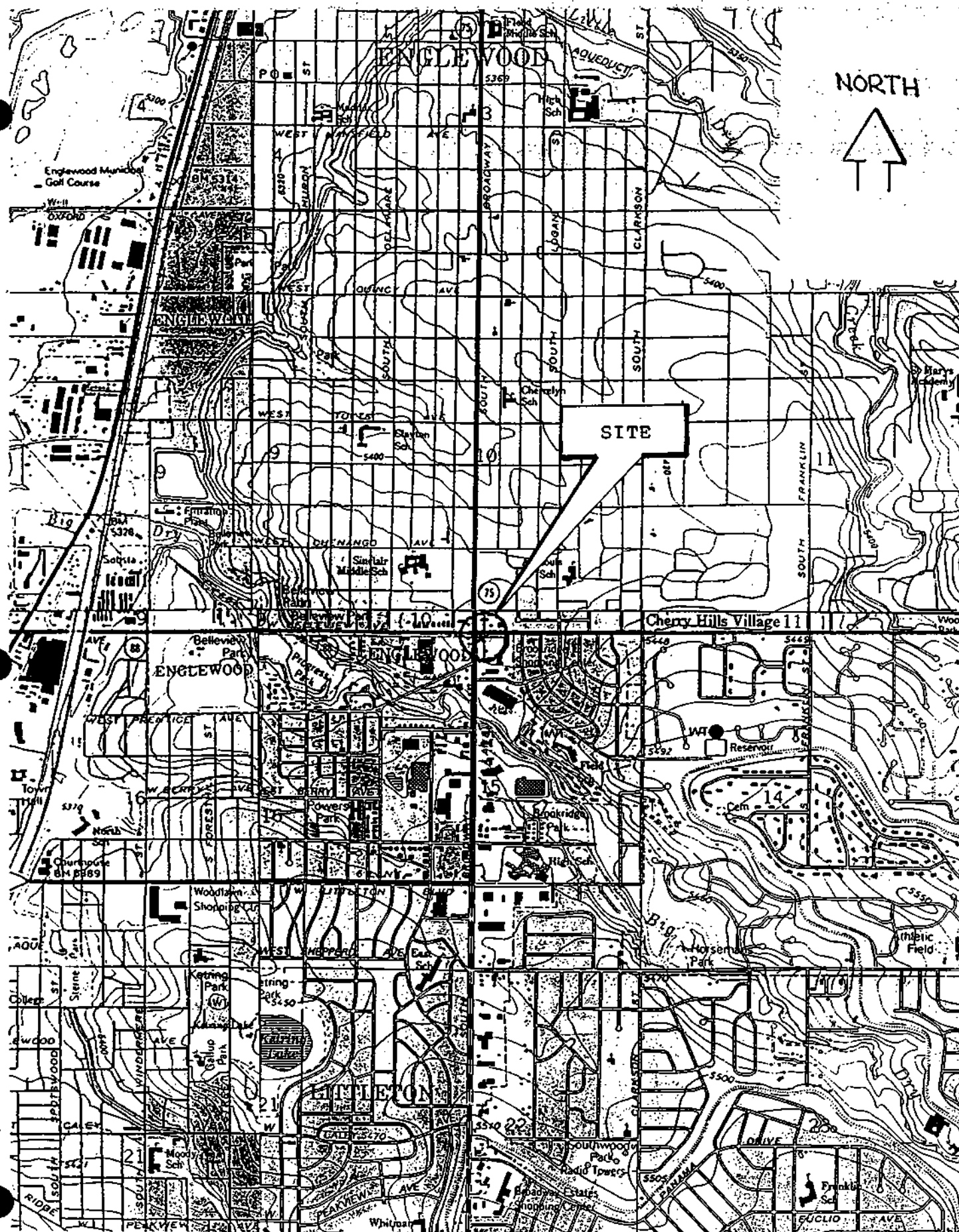


FIGURE 2. SITE TOPOGRAPHIC MAP (1:24,000)
BROADWAY AND BELLEVUE PCE

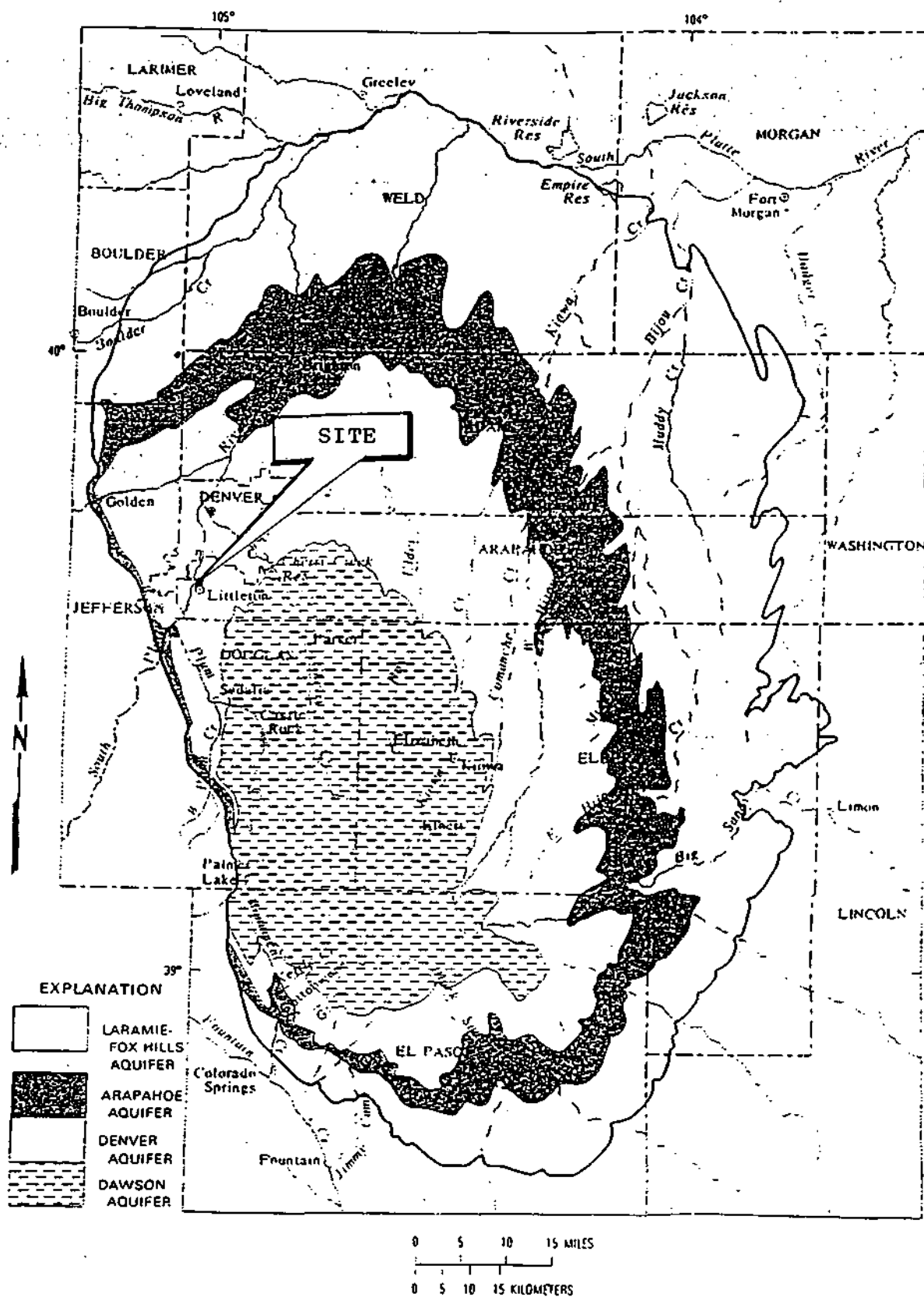


FIGURE 3. SITE BEDROCK AQUIFER LOCATION MAP
BROADWAY AND BELLEVUE PCE

(SOURCE: ROBSON, 1987)

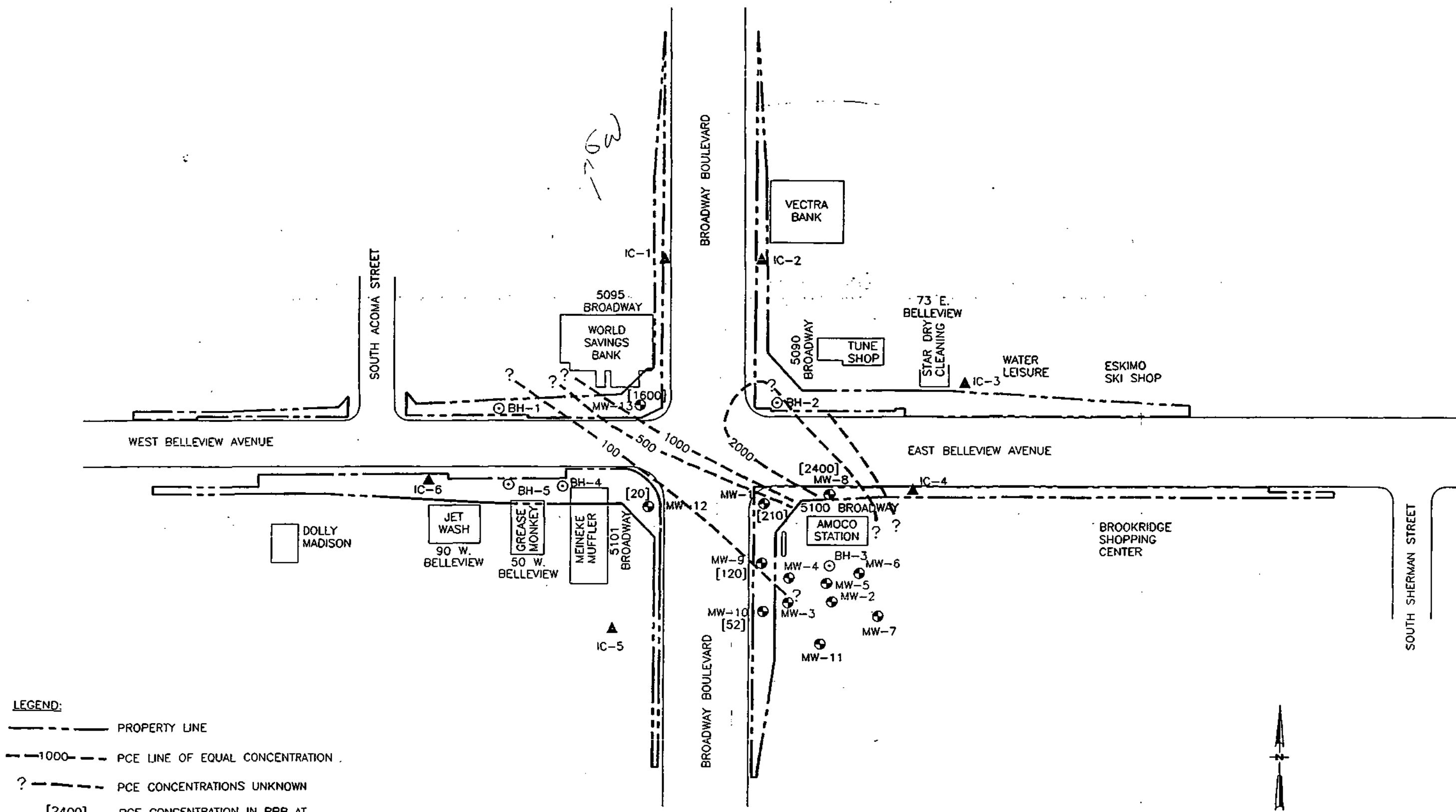


FIGURE 4. SITE SKETCH MAP (As copied from Industrial Compliance, 1995)
BROADWAY AND BELLEVUE PCE

LEGEND:

— PROPERTY LINE

- - - 1000 - - - PCE LINE OF EQUAL CONCENTRATION

? - - - PCE CONCENTRATIONS UNKNOWN

[2400] PCE CONCENTRATION IN PPB AT MONITOR WELL

MW-8 ● EXISTING MONITOR WELL LOCATION INSTALLED BY AMOCO/CHEVRON AND

▲ IC MONITOR WELL LOCATION

○ IC BOREHOLE LOCATION

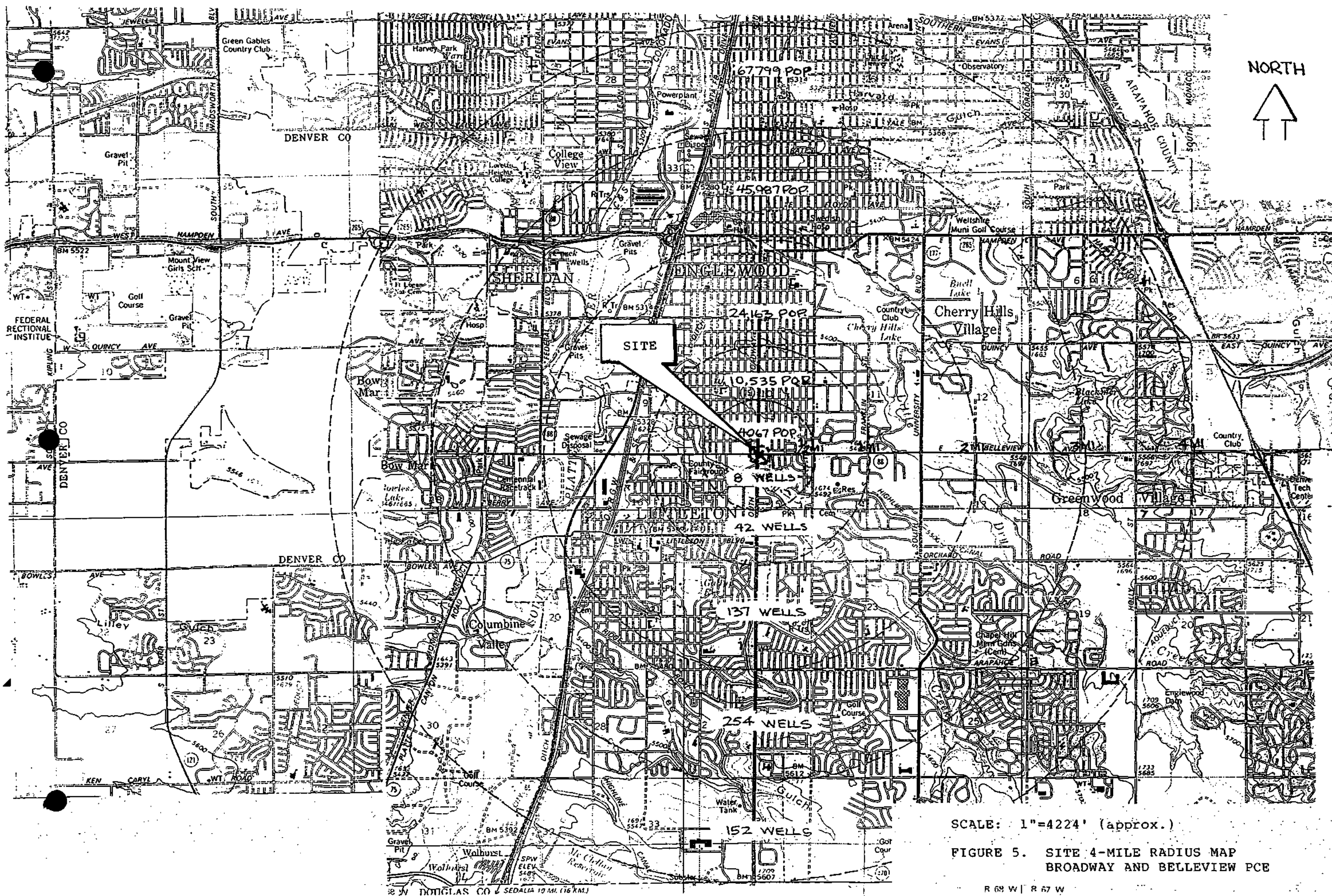
NOTE: DUE TO PROPERTY ACCESS AGREEMENT PROBLEMS, BOREHOLES BH-1, BH-2, AND IC-1 WERE NOT COMPLETED DURING THIS PSI.

Industrial Compliance
A Subsidiary of SP Environmental Systems, Inc.

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APPROXIMATE SCALE (FEET)

FIGURE 4
PCE CONCENTRATION MAP
COLORADO DEPARTMENT OF TRANSPORTATION
BROADWAY AND BELLEVUE



SCALE: 1"=4224' (approx.)

FIGURE 5. SITE 4-MILE RADIUS MAP
BROADWAY AND BELLEVUE PCE

R 69 W | R 67 W

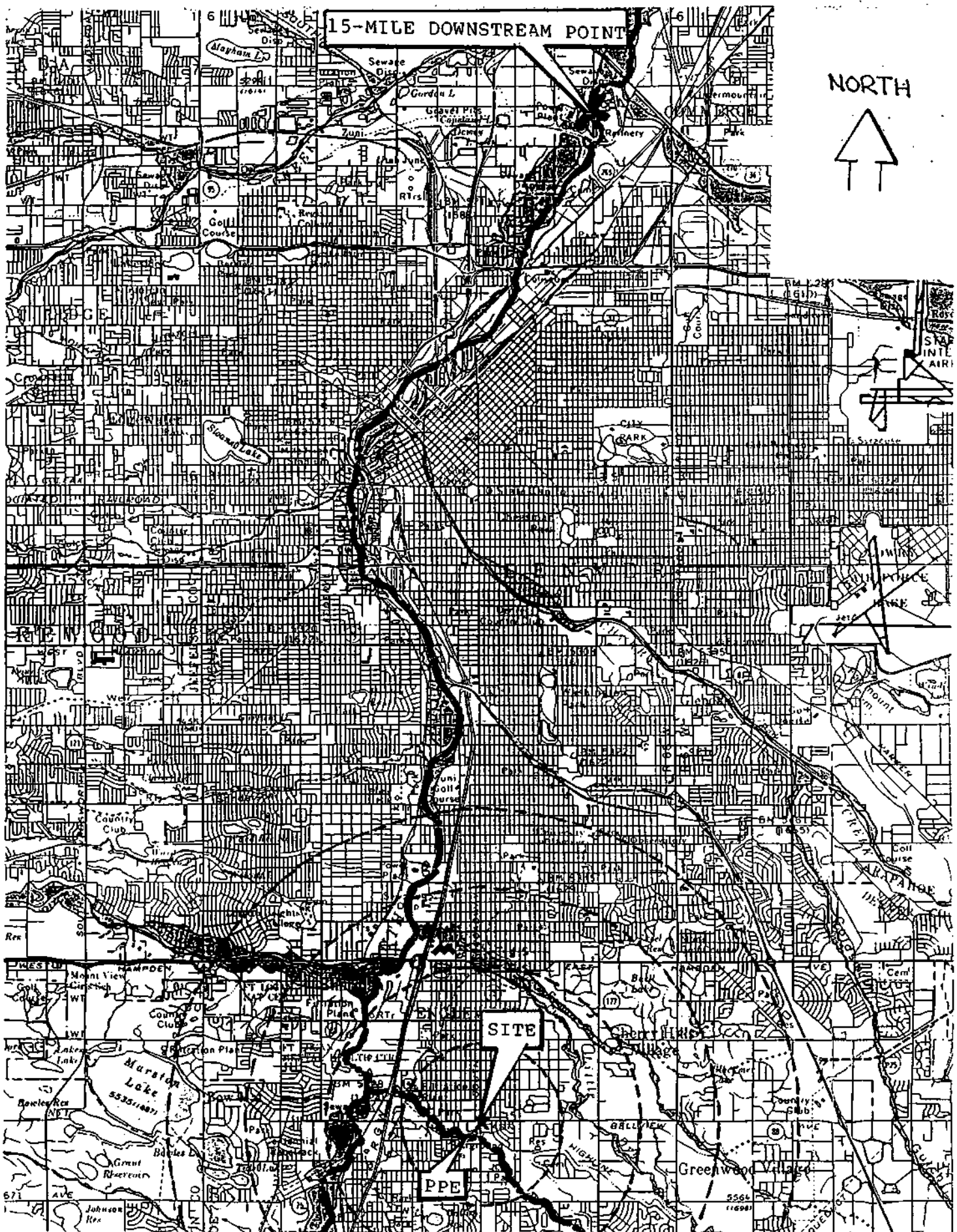


FIGURE 6. SITE 15-MILE DOWNSTREAM MAP
BROADWAY AND BELLEVUE PCE

SOIL ORGANIC COMPOUND ANALYTICAL RESULTS

Parameter	Sample Location						
	BH-3 (8'-9')	BH-4 (8'-9')	BH-5 (0.3'-1.5')	IC-2 (9'-10.5')	IC-3 (14'-15.5')	IC-4 (9'-10.5')	IC-6 (9'-10.5')
VOCs:							
Acetone	16 BJ	13 BJ	74 BJ	19 BJ	17 BJ	15 BJ	19 BJ
Chloroform	U	1 J	U	U	U	U	U
SVOCs:							
bis (2-Ethylhexyl) Phthalate	U	U	U	U	22 J	23 J	U
Phenanthrene	U	U	42 J	U	U	U	U
Fluoranthene	U	U	90 J	U	U	U	U
Pyrene	U	U	130 J	U	U	U	U
Benzo(a)Anthracene	U	U	54 J	U	U	U	U
Chrysene	U	U	74 J	U	U	U	U
Benzo(b)Fluoranthene	U	U	73 J	U	U	U	U
Benzo(a)Pyrene	U	U	51 J	U	U	U	U
Indeno(1,2,3-cd) Pyrene	U	U	31 J	U	U	U	U
Benzo(g,h,i)Perylene	U	U	32 J	U	U	U	U

Notes: VOC and SVOC results reported in ppb

J = estimated value below the PQL

B = compound detected in blank sample

U = compound not detected

TABLE 1. SOIL ORGANIC COMPOUND ANALYTICAL RESULTS
Industrial Compliance, Preliminary Site Investigation,
1995.

SOIL PRIORITY POLLUTANT METAL RESULTS

Priority Pollutant Metal	Sample Location													EPA SW-874 Soil Common Range Values
	BII-3 (8'-9')	BII-4 (8'-9')	BII-5 (0.3'-1.5')	IC-2 (9'-10.5')	IC-2 (19'-20.5')	IC-3 (14'-15.5')	IC-3 (22.5'-24')	IC-4 (9'-10.5')	IC-4 (23'-24')	IC-5 (9'-10.5')	IC-5 (14'-15.5')	IC-6 (9'-10.5')	IC-6 (14'-15.5')	
Antimony	<6.9	<6.9	<6.9	<6.9	<6.9	9.2	<6.9	<6.9	<6.9	<6.9	<6.9	<6.9	<6.9	2-10
Arsenic	19	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	14	<12	1-50
Beryllium	0.63	0.72	0.46	0.57	0.7	2.4	0.7	0.59	0.9	1.4	7.3	1.7	3.7	0.1-40
Cadmium	<0.5	1.4	2.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	0.5	0.01-0.7
Chromium	12	10	8.1	10	7.8	13	7.0	11	7.9	7.7	6.5	7.7	7.0	1-1,000
Copper	20	16	38	110	19	18	17	20	17	11	14	10	21	2-100
Lead	<5.5	<5.5	16	<5.5	110	<5.5	200	<5.5	210	<5.5	290	<5.5	180	2-200
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.6	0.01-0.3
Nickel	6.1	8.2	10	7.2	<4	11	<4	10	<4	11	4	7.4	4	5-500
Selenium	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	0.1-2
Silver	10	6.3	<2.1	7.9	15	8.7	14	<2.1	16	<2.1	14	5.1	14	0.01-5
Thallium	<8	<8	<8	8.7	11	<8	<8	<8	<8	<8	11	<8	<8	---
Zinc	59	40	100	65	94	65	90	75	100	40	72	46	99	10-300

Notes: All results reported in parts per million (ppm)

< = less than

B = element detected in reagent blank

--- = common range value not established

Shaded areas indicate metals above the common range values

TABLE 1a. SOIL PRIORITY POLLUTANT METAL RESULTS
Industrial Compliance, Preliminary Site Investigation, 1995.

GROUND-WATER ORGANIC COMPOUND RESULTS

Parameter	Sample Location							CGWS
	MW-1	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	
VOCs:								
Acetone	U	140 BJ	19 J	13 J	17 J	U	12 J	NE
Benzene	1 J	U	2 J	1 J	U	U	U	5
Chloromethane	2 J	U	U	2 J	U	U	2 J	NE
1,2-Dichloroethane	1 J	54	U	U	U	U	1 J	0.4
cis 1,2-Dichloroethene	2 J	U	U	U	U	U	7	70
Tetrachloroethene	210	2,400	120	52	U	20	1,600	5
Trichloroethene	12	25 J	2 J	1 J	U	1 J	22	5
SVOCs:								
Naphthalene	U	U	1 J	U	U	U	U	NE
4-Methylphenol	U	U	U	U	U	1 J	U	NE
bis(2-Ethylhexyl)Phthalate	U	U	U	U	U	1 JB	1 JB	6

Notes: All results reported in parts per billion (ppb)
 J = estimated value below the laboratory PQL
 B = compound detected in blank sample
 U = compound not detected
 CGWS = Colorado Ground-Water Standards
 NE = CGWS not established for this compound
 Shaded areas indicate VOCs above the CGWS

TABLE 2. GROUND WATER ORGANIC COMPOUND RESULTS
 Industrial Compliance, Preliminary Site Investigation, 1995.

GROUND-WATER PRIORITY POLLUTANT METAL RESULTS

Priority Pollutant Metal	Sample Location							CGWS
	MW-1	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	
Antimony	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	0.006
Arsenic	<0.0018	<0.0018	0.002	<0.0018	<0.0018	<0.0018	<0.0018	0.05
Beryllium	<0.001B	<0.001B	<0.001B	<0.001B	<0.001B	<0.001B	<0.001	0.004
Cadmium	<0.005	0.012	0.007	0.016	0.012	<0.005	0.011B	0.005
Chromium	<0.0016B	<0.0016B	<0.0016B	<0.0016B	0.018B	<0.0016B	<0.016	0.05
Copper	0.010	0.008	0.006	0.0047	0.0052	0.0033	<0.003B	1.0
Lead	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	0.05
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002
Nickel	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	0.1
Selenium	<0.0039	<0.0039	<0.0039	<0.0039	0.0097	<0.0039	<0.0039	0.01
Silver	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	0.05
Thallium	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	0.002
Zinc	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	5.0

Notes: All results reported in parts per million (ppm)

< = less than

B = element detected in reagent blank

CGWS = Colorado Ground-Water Standard

Shaded areas indicate metals above the CGWS

TABLE 2a. GROUND WATER PRIORITY POLLUTANT METAL RESULTS
Industrial Compliance, Preliminary Site Investigation, 1995.

TABBED PAGE

APPENDIX 1

**EPA Guidance
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**ATTACHMENT III
CERCLA ELIGIBILITY WORKSHEET**

CERCLA Eligibility Worksheet

Site Name Broadway and Belview PCE

City Englewood

State Colorado

EPA ID Number _____

Note: The site is automatically CERCLA eligible if it is a Federally owned or operated RCRA site.

I. CERCLA Eligibility

Did the facility cease operations prior to November 19, 1980? No

If YES, then STOP. The facility is probably a CERCLA site.
If NO, continue to Part II.

II. RCRA Deferral Factors

Did the facility file a RCRA Part A application? No

If YES:

1. Does the facility currently have interim status? _____
2. Did the facility withdraw its Part A application? _____
3. Is the facility a known or possible protective filer? _____
(filed in error)
4. Does the facility have a RCRA operating or post-closure permit? _____
5. Is the facility a late (after 11/19/80) or non-filer that has been identified by the EPA or the State? (facility did not know it needed to file under RCRA). _____

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Type of facility:

**Generator ____ Transporter ____ Recycler ____
TSD (Treatment/Storage/Disposal) ____**

If all answers to questions 1, 2, and 3 are NO, STOP. The facility is a CERCLA eligible site.

If answer to #2 or #3 is YES, STOP. The facility is a CERCLA eligible site.

If answer to #2 and #3 are NO and any other answer is YES, site is RCRA, continue to Part III.

III. RCRA Sites Eligible for the NPL

Has the facility owner filed for bankruptcy under Federal or State laws? No

Has the facility lost RCRA authorization to operate or shown probable unwillingness to carry out corrective action? _____

Is the facility a TSD that converted to a generator, transporter or recycler facility after November 19, 1980? _____

IV. Exempted substances:

Does the release involve hazardous substances other than petroleum? Yes

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V. Other programs: The site may never reach the NPL or be a candidate for removal. We need to be able to refer it to any other programs in EPA or state agencies which may have jurisdiction, and thus be able to effect a cleanup. Responses should summarize available information pertaining to the question. Include information in existing files in these programs as part of the PA. Answer all that apply.

Is there an owner or operator?

Amoco Oil for Amoco service station. Additional owners may be identified as the source area is clarified.

NPDES-CWA: Is there a discharge water containing pollutants with surface water through a point source (pipe, ditch, channel, conduit, etc.)?

No

CWA (404): Have fill or dredged material been deposited in a wetland or on the banks of a stream? Is there evidence of heavy equipment operating in ponds, streams or wetlands?

No

UIC-SDWA: Are fluids being disposed of to the subsurface through a well, cesspool, septic system, pit, etc.?

No

TSCA: Is it suspected that there are PCB's on the site which came from a source with greater than 50 ppm PCB's such as oil from electrical transformers or capacitors?

No

FIFRA: Is there a suspected release of pesticides from a pesticide storage site? Are there pesticide containers on site?

No

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RCRA (D) Is there an owner or operator who is obligated to manage solid waste storage or disposal units under State solid waste or ground water protection regulations?

?

UST: Is it suspected that there is a leaking underground storage tank containing a product which is a hazardous substance or petroleum?

?

TABBED PAGE

APPENDIX 2

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ATTACHMENT IV

PA Form

OMB Approval Number: 2050-0095
Approved for Use Through: 1/92

EPA Potential Hazardous Waste Site Preliminary Assessment Form		Identification				
		State:		CERCLIS Number: C00001104264		
		CERCLIS Discovery Date: October 1, 1994 5/29/95 POS				
1. General Site Information						
Name: Broadway & Belleview PCE			Street Address: 5100 South Broadway			
City: Englewood			State: CO	Zip Code: 80110	County: Arapahoe	Co. Code:
Latitude: 39° 37' 26.0"			Longitude: 104° 59' 14.0"		Approximate Area of Site: 11.5 Acres Square Ft	
Status of Site: <input checked="" type="checkbox"/> Active <input type="checkbox"/> Not Specified <input checked="" type="checkbox"/> Inactive <input type="checkbox"/> NA (GW plume, etc.)						
2. Owner/Operator Information						
Owner: Amoco Oil			Operator:			
Street Address:			Street Address:			
City:			City:			
State:	Zip Code:	Telephone:	State:	Zip Code:	Telephone:	
()			()			
Type of Ownership: <input checked="" type="checkbox"/> Private <input type="checkbox"/> Federal Agency Name: _____ <input type="checkbox"/> State <input type="checkbox"/> Indian			How Initially Identified: <input type="checkbox"/> Citizen Complaint <input type="checkbox"/> PA Petition <input type="checkbox"/> State/Local Program <input type="checkbox"/> RCRA/CERCLA Notification			
<input type="checkbox"/> County <input type="checkbox"/> Municipal <input type="checkbox"/> Not Specified <input type="checkbox"/> Other _____			<input checked="" type="checkbox"/> Federal Program <input type="checkbox"/> Incidental <input type="checkbox"/> Not Specified <input type="checkbox"/> Other _____			
3. Site Evaluator Information						
Name of Evaluator: S. V. (Vari) Simsman		Agency/Organization: CDPHE		Date Prepared: November 5, 1996		
Street Address: 4300 Cherry Creek Drive South		City: Denver		State: CO		
Name of EPA or State Agency Contact: Pat Smith		Street Address: 999 18th Street, #500				
City: Denver		State: CO	Telephone: 303, 293-1262			
4. Site Disposition (for EPA use only)						
Emergency Response/Removal Assessment Recommendation: <input type="checkbox"/> Yes <input type="checkbox"/> No Date: _____		CERCLIS Recommendation: <input type="checkbox"/> Higher Priority SI <input type="checkbox"/> Lower Priority SI <input type="checkbox"/> NFRAP <input type="checkbox"/> RCRA <input type="checkbox"/> Other _____ Date: _____		Signature: Name (typed): Position:		



Potential Hazardous Waste Site
Preliminary Assessment Form - Page 2 of 4

CERCLIS Number:

5. General Site Characteristics

Predominant Land Uses Within 1 Mile of Site (check all that apply):

- ☒ Industrial ☐ Agriculture ☐ DOI
☒ Commercial ☐ Mining ☐ Other Federal Facility
☒ Residential ☐ DOD
☐ Forest/Fields ☐ DOE ☐ Other _____

Site Setting:

- ☐ Urban
☒ Suburban
☐ Rural

Years of Operation: 1951

Beginning Year _____

Ending Year _____

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)

- ☐ Lumber and Wood Products
☐ Inorganic Chemicals
☐ Plastic and/or Rubber Products
☐ Paints, Varnishes
☐ Industrial Organic Chemicals
☐ Agricultural Chemicals
(e.g., pesticides, fertilizers)
☐ Miscellaneous Chemical Products
(e.g., adhesives, explosives, ink)
☐ Primary Metals
☐ Metal Coating, Plating, Engraving
☐ Metal Forging, Stamping
☐ Fabricated Structural Metal Products
☐ Electronic Equipment
☐ Other Manufacturing

☐ Mining

- ☐ Metals
☐ Coal
☐ Oil and Gas
☐ Non-metallic Minerals

☒ Retail

- ☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill _____
☐ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _____
☐ RCRA

☐ Treatment, Storage, or Disposal

☐ Large Quantity Generator

☐ Small Quantity Generator

☐ Subtitle D

☐ Municipal

☐ Industrial

☐ "Converter"

☐ "Protective Filer"

☐ "Non- or Late Filer"

☒ Not Specified

☐ Other Services

Waste Generated:

- ☒ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

- ☐ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☒ Unknown

Waste Accessible to the Public:

- ☐ Yes
☒ No

Distance to Nearest Dwelling,
School, or Workplace:

_____ Feet

6. Waste Characteristics Information

Source Type:
(check all that apply)

- ☐ Landfill
☐ Surface Impoundment
☐ Drums
☐ Tanks and Non-Drum Containers
☐ Chemical Waste Pile
☐ Scrap Metal or Junk Pile
☐ Tailings Pile
☐ Trash Pile (open dump)
☐ Land Treatment

☒ Contaminated Ground Water Plume
(unidentified source)

☐ Contaminated Surface Water/Sediment
(unidentified source)

☒ Contaminated Soil

☐ Other _____

☐ No Sources

Source Waste Quantity:
(include units)

unknown

11.5 acres

Tier ^B:

A

General Types of Waste (check all that apply)

- ☐ Metals ☐ Pesticides/Herbicides
☐ Organics ☐ Acids/Bases
☐ Inorganics ☒ Oily Waste
☒ Solvents ☐ Municipal Waste
☒ Paints/Pigments ☐ Mining Waste
☐ Laboratory/Hospital Waste ☐ Explosives
☐ Radioactive Waste ☐ Other _____
☐ Construction/Demolition
Waste

Physical State of Waste as Deposited (check all that apply):

- ☐ Solid ☐ Sludge ☐ Powder
☐ Liquid ☐ Gas

* C = Constituent, W = Wastestream, V = Volume, A = Area

TABBED PAGE APPENDIX 3

**PA GUIDANCE
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ATTACHMENT V

PA Worksheet

PA WORKSHEET

Site Name Broadway and Belleview PCE City, State Englewood,
Colorado

CERCLIS # CO0001104264

Reported by S. V. (Van) Simsiman Date November 5, 1996

HIGHLIGHTS

- A.) IS THERE QUALITATIVE OR QUANTITATIVE EVIDENCE OF A RELEASE TO AIR, SURFACE WATER, GROUND WATER, OR SURFACE SOIL? DESCRIBE BRIEFLY.**
More detail in items GW-1 (for GW), SW-5 (for SW), A-1 (for air), and SE-1 (for soil exposure pathway).

Volatile organic compounds (VOCs) such as Acetone, Benzene, Chloromethane, Tetrachloroethene (PCE), Trichloroethene (TCE), 1,2-Dichloroethane (1,2-DCA), and Cis 1,2-dichloroethane (cis 1,2-DCA) have been detected in the ground water at the South Broadway/Bellevue intersection.

- B.) IS THERE EVIDENCE OF AN IMPACTED TARGET POPULATION? DESCRIBE.**

PATHWAY	TARGET	none/target size	BRIEF DESCRIPTION	MORE DISCUSSION IN
Ground Water	public drinking water supply	0		
	domestic drinking water supply	0		
Surface Water	drinking water	0		
	fishery	0		
	sens. env.	0		
Soil Exposure	people w/in 200'	0		
	terrestrial sens. env.	0		
Air	population	0		

SITE INFORMATION

G-1. Directions to the site (from nearest easily recognized point.)

From Denver, drive south on South Broadway for about 7.75 miles to Bellevue Avenue. Turn left on Bellevue and enter onto the empty and inactive Amoco service station at the southeast corner of the South Broadway/Bellevue intersection. Amoco, at 5100 South Broadway, is the reference center of the Broadway and Bellevue PCE site area.

G-2. Are there other potential sources in the neighborhood to be aware of as the site is evaluated? e.g., is the site in an industrial area, near a railroad, along a highway? Are sources with similar contaminants to this site in the vicinity?

The site is ground water contamination below service/commercial business complex around the South Broadway/Bellevue intersection. It includes past and present service operations which may have or had potentially contributed to the VOC contamination in the ground water. Past operations at the site include service stations/automotive repair shops, such as Amoco (formerly Chevron), Conoco, Skelly and Enco. Star Cleaners currently operates at the site, succeeding previous operators in the dry cleaning plant at 73 E. Bellevue. Also, Tune Shop, Grease Monkey, and Meineke Mufflers are presently operating at the site.

Background/Operating History

G-3. Describe the operating history of the site.

Historically, the four corners of the South Broadway/Bellevue intersection were home to Chevron, Conoco, Skelly, and Enco service station/auto repair operations during the 1950s through the 1970s. Amoco, though presently inactive, took over the former Chevron service station and had been the focus of several subsurface investigations. Star Cleaners succeeded three other operators of the same dry cleaning plant that started in 1958.

Source of information: Industrial Compliance, initial Site Assessment 1994.
Sierra Environmental, Subsurface Investigation Report, 1990.

G-4. Describe site and nature of operations (property size, manufacturing, waste disposal, storage etc.):

Operations at the four corners of the South Broadway/Bellevue intersection are summarized as follows:
Southeast corner: Amoco, since 1990, formerly Chevron since 1951; Northeast corner: Tune Shop since 1993; Precision and then Mountain States Tune-Up operated some facility during 1980 to 1990. Conoco started and operated facility during 1960-1980. Adjacent facility is dry cleaning plant currently operated by Star Cleaners, succeeding Country Club, Your Valet, and One-Hour Martinizing, which started plant in 1958. Northwest corner: Skelly service and auto repair operated in vicinity during 1955-1975. Southwest corner: Meineke Mufflers since 1993, succeeding House of Mufflers, which operated facility during 1980-1990. Formerly Enco and Carter service station during 1955-1960.

Source of information: Industrial Compliance, Initial Site Assessment, 1994.

G-5. Describe any emergency or remedial actions that have occurred at the site:

Vapor extraction system (VES) was installed at Amoco (formerly Chevron) after 1990 when high levels of BTEX and TPH were detected at property, resulting from leaking underground storage tanks (LUST). VES is at south portion of property.

Source of information: Sierra Environmental Services, Subsurface Investigation Report, 1990.
Delta Environmental Consultants, Subsurface Investigation Report, 1993.

G-6. Are there records or knowledge of accidents or spills involving site wastes? Are there Emergency Response Notification (ERNs) reports for this location?

No

Source of information:

G-7. Describe existing sampling data and briefly summarize data quality (e.g. sample objective, age/comparability, analytical methods, detection limits, QA/QC validatability):

See Appendix 5 - Text: Industrial Compliance, Preliminary Site Investigation

Source of information:

G-8. Is there any other local, state, or federal regulatory involvement? Describe. Include permits, and names of contact individuals within each government organization.

AGENCY	PROGRAM	CONTACT	PHONE	PERMIT
Colorado Department of Labor	Storage Tank Remediation	Dennis Hotovec	620-4300	
Tri-County Health Department	Environmental Health	Warren Brown	220-9200	

G-9. Attach site sketch or schematic. Include all pertinent features including wells, storage areas, underground storage tanks, source areas

See Figure 4

SOURCE CHARACTERIZATION

WC-1. Describe each source at the site, on Table 1, in terms of source type, containment, size/area/volume/quantity, and substances present. See HRS Tables 2-5 and 5-2 for source descriptions, Tables 3-2, 4-2, 4-8, 5-6, 6-3, and 6-9 for containment.

Sources at the site are categorized as Other - Ground Water PCE with estimated volume of an acre-foot or 1613 cu. yds., and as Contaminated Soils with estimated area of 11.5 acres. See Table 1.

WC-2. Briefly describe how waste quantity was estimated (eg. historical records or manifests, permit applications, air photo measurements, etc.):

Estimates provided in WC-1 above are evaluator's guess estimates based on historical background of site and site visit.

Source of information: Site visit, July 6, 1995.

WC-3. Describe any restrictions or barriers to accessibility of onsite sources.

VOC-contaminated ground water is not known to be at the ground surface.

Source of information:

GROUND WATER CHARACTERISTICS

GW-1. Any positive or circumstantial evidence of a release to ground water? Describe.

From sampling events in 1995, PCE, TCE, and 1,2-DCA were detected in ground water (dissolved) at concentrations that exceed Colorado Ground Water Standards (CGWS) for these substances. Acetone, benzene, chloromethane and cis 1,2-DCA were also detected in ground water but below CGWS. See Table 2 of text.

Source of Information: Industrial Compliance, Preliminary Site Investigation, 1995.

GW-2. Any positive or circumstantial evidence of a release to drinking water users? Describe analytes, detection limits, background, hits, number of users, locations, QA/QC.

No.

Source of information:

GW-3. Briefly describe the geologic setting.

The site is on the western flank of the Denver Basin. It is situated on the surficial deposits in the South Platte River Valley consisting of Quaternary sediments of Eolian sand and Loess of Holocene and Pleistocene age.

GW-4. Describe geologic/hydrogeologic units on Table 2. Give names, descriptions, and characteristics of consolidated and unconsolidated zones beneath the site.

See Table 2

GW-5. Is the site in an area of karst terrain or a karst aquifer?

No

GW-6. Net Precipitation (per HRS section 3.1.2.2).

3.9 inches

SURFACE WATER CHARACTERISTICS

SW-1. Mean annual precipitation (per HRS section 4.0.2) = 16. If less than 20", then count intermittent channels as surface water.

SW-2. Discuss the probable surface water flow pattern from the site to surface waters:

Surface water runoffs from the site are captured into the existing stormwater guttering system around the South Broadway/Bellevue intersection. Otherwise, the natural direction of runoffs would be south-southwest towards the Big Dry Creek, which is about 1,000 feet from the site.

Source of information: Site visit, July 6, 1995; Site Topographic Map

SW-3. If surface water exists within 2 miles of the site, describe surface water segments within the 15-mile distance limit.

Segment Name	River/Lake/ type	Fresh/Salt Water	Start (mi.)	End (mi.)	flow in cfs
Big Dry Creek	River	Fresh			
South Platte River	River	Fresh			

Ground water to surface distance _____ Angle 0 _____

SW-4. Provide a schematic diagram or simple figure which describes surface water segments, locates targets, identifies flow direction, PPE(s), etc. Refer to figure(s) submitted with text of report if appropriate.

See Figure 6 of text

SW-5. Any positive or circumstantial evidence of a release to surface water? Evidence of a release by direct observation? Is the source located in surface water? Describe.

No

Source of information:

SW-6. Any positive or circumstantial evidence of a release to surface water target populations? Describe analytes, detection limits, background, hits, number of users, locations, QA/QC.

No

Source of information:

SW-8. Is the site or portions thereof located in surface water?

Is the site located in the 1 - <10 yr floodplain? No

>10-100 yr? No

>100-500 yr? Yes

>500 yr?

SW-9. Two-year 24-hour rainfall 1.5 inches.

TARGETS

T-1. Discuss ground water usage within four mile of the site:

Used for domestic, municipal, commercial, and industrial purposes. 20 newer domestic wells located upgradient southwest within 2-4 mile segment are assumed to be in use serving about 48 people. 20 municipal wells located upgradient east-southeast belong to small semi-public and private water districts with two districts indicated to be serving 1175 people.

Source of information: State Engineer's Office, Well Permit Database

T-2. Summarize the drinking water population served via Ground Water within 4 miles of the site:

0 - 1/4 mi	<u>0</u>
1/4 - 1/2 mi	<u>0</u>
1/2 - 1 mi	<u>0</u>
1 - 2 mi	<u>0</u>
2 - 3 mi	<u>600</u>
3 - 4 mi	<u>623</u>

Attach calculations for population apportionment in blended systems.

T-3. Identify and locate any of the following surface water targets within 15 miles of the site: drinking water population(s) served by intakes, fisheries, sensitive environments described in Table 4-23 of the HRS, and wetlands as defined in the Federal Register.

Targets	dist. from site	SW body	flow in cfs	population served/size (incl. units)	contamination known/suspected
Englewood SW Intake 2	1.0	City Ditch	20	6000	-
Englewood SW Intake 1	1.5	South Platte River	300	24,000	-
Fishery	1.5	South Platte River	300	-	-
Sensitive Environment	1.0	Bid Dry Creek	<20	-	-
Sensitive Environment	1.5	South Platte River	300	-	-

T-4. Summarize the population within a four-mile radius of the site:

	<u>Total Pop.</u>	<u>worker pop.</u>
onsite	<u> </u>	60-90
0 - 1/4 mi	<u>913</u>	
1/4 - 1/2 mi	<u>3,154</u>	
1/2 - 1 mi	<u>10,635</u>	
1 - 2 mi	<u>24,163</u>	
2 - 3 mi	<u>45,987</u>	
3 - 4 mi	<u>67,799</u>	

1203, public water supply wells, clean

T-5. Identify and locate any terrestrial sensitive environments described in Table 5-5 of the HRS.

None

T-6. Describe any positive or circumstantial evidence of a release to air target populations? Of a release by direct observation where target population exists within 1/4 mile of the site? Describe analytes, detection limits, background, hits, number of users, locations, QA/QC.

None

T-7. Identify and locate any potential or known resident soil exposure populations, if present. Describe conditions which lead the researcher to suspect contaminated soil within 200' of residences, if this condition exists.

NA

TABLE 1

WASTE CONTAINMENT AND HAZARDOUS SUBSTANCE IDENTIFICATION¹

SOURCE TYPE	SIZE (Volume/Area)	ESTIMATED WASTE QUANTITY	SPECIFIC COMPOUNDS	CONTAINMENT ²	SOURCES OF INFORMATION
Other Ground Water PCE	Unknown		PCE, TCA, 1-2-DCA Also, Acetone, Benzene, Chloroethane, cis, 1-2- DCA	GW-non-existent SW-non-existent Air non-existent	Industrial Compliance, 1995
Contaminated Soils	11.5 acres (estimate)		Cadmium, Copper, Silver, Acetone, chloroform	GW-non-existent SW-paved parking bldg Air non-existent	Industrial Compliance, 1995

¹ Use additional sheets if necessary

² Evaluate containment of each source from the perspective of each migration pathway (e.g., ground water pathway - non-existent, natural or synthetic liner, corroding underground storage tank; surface water - inadequate freeboard, corroding bulk tanks; air - unstabilized slag piles, leaking drums, etc.)

TABLE 2
HYDROGEOLOGIC INFORMATION¹

STRATA NAME/DESCRIPTION	THICKNESS (ft.)	HYDRAULIC CONDUCTIVITY (cm/sec)	TYPE OF DISCONTINUITY²	SOURCE OF INFORMATION
Alluvium-Eolian Sand and Loess of Holocene and Pleistocene Age	10' x 30'	Variable	-	Shroba, 1979
Denver/Arapahoe Formations	up to 800'	Variable	-	Robson, 1987

¹ Use additional sheets if necessary

² Identify the type of aquifer discontinuity within four miles from the site (e.g., river, strata "pinches out," etc.)

TABBED PAGE

APPENDIX 4

Color Photo(s)

The following pages
contain color that does
not appear in the
scanned images.

To view the actual images, please
contact the Superfund Records
Center at (303) 312-6473.

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION



BROADWAY AND BELLEVIEW PCE

Description of photo: At back driveway by South Acoma

St. west of World Savings, looking south towards Grease

Monkey and Jet Wash.

Date: July 6, 1995 Time: 10:10 am

Witness: None

Direction facing: South Film(35mm) X other



BROADWAY AND BELLEVIEW PCE

Description of photo: At back driveway by South Acoma

St. west of World Savings, looking southeast towards

South Broadway/Belleview intersection, World Savings
and Meinecke Mufflers.

Date: July 6, 1995 Time: 10:12 am

Witness: None

Direction facing: Southeast Film(35mm) X other

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION



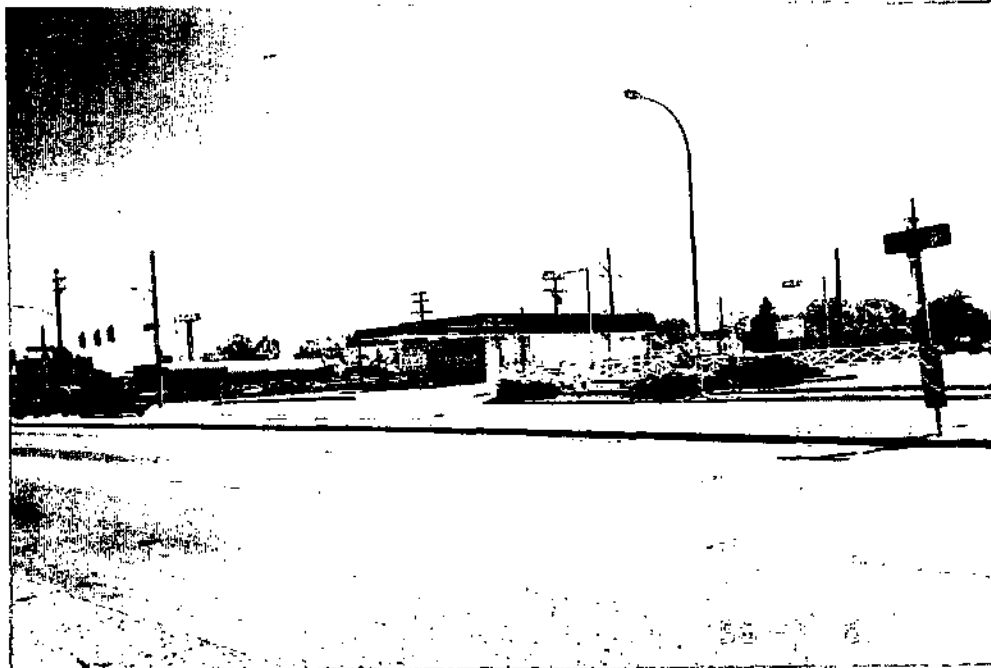
BROADWAY AND BELLEVUE PCE

Description of photo: At South Broadway curb south of South
Broadway/Belleview intersection, looking slightly
northeast towards Meinecke Mufflers and Vectra Bank

Date: July 6, 1995 Time: 10:20 am

Witness: None

Direction facing: Slightly Northeast Film(35mm) ☒ other ☐



BROADWAY AND BELLEVUE PCE

Description of photo: At South Broadway curb south of South
Broadway/Belleview intersection, looking northeast
directly towards Amoco Service Station (formerly Chevron)

Date: July 6, 1995 Time: 10:21 am

Witness: None

Direction facing: Northeast Film(35mm) ☒ other ☐

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION



BROADWAY AND BELLEVIEW PCE

Description of photo: At southwest corner of South Broadway/Belle-
view intersection, looking east towards Amoco Service
Station (formerly Chevron).

Date: -July -6, 1995 Time: 10:30 am

Witness: None

Direction facing: East Film(35mm) X other



BROADWAY AND BELLEVIEW PCE

Description of photo: At southwest corner of South Broadway/
Belleview intersection, looking northeast towards Tune Shop
and Star Cleaners.

Date: July 6, 1995 Time: 10:32 am

Witness: None

Direction facing: Northeast Film(35mm) X other

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION



BROADWAY AND BELLEVUE PCE

Description of photo: At southeast corner of South Broadway/

Bellevue intersection in front of Amoco, northeast

towards Star Cleaners.

Date: July 6, 1995 Time: 10:35 am

Witness: _____

Direction facing: _____ Film(35mm) _____ other _____



BROADWAY AND BELLEVUE PCE

Description of photo: At southeast corner of South Broadway/

Bellevue intersection in front of Amoco, looking north

towards Tune Shop (formerly Conoco).

Date: July 6, 1995 Time: 10:36 am

Witness: _____

Direction facing: _____ Film(35mm) _____ other _____

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION



BROADWAY AND BELLEVIEW PCE

Description of photo: At northeast corner of South Broadway/
Bellevue intersection, looking south down South Broadway.

Date: July 6, 1995 Time: 10:40 am

Witness: None

Direction facing: South Film(35mm) x other



BROADWAY AND BELLEVIEW PCE

Description of photo: At northeast corner of South Broadway/
Bellevue intersection, looking west towards World
Savings.

Date: July 6, 1995 Time: 10:41 am

Witness: None

Direction facing: West Film(35mm) x other

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION



BROADWAY AND BELLEVIEW PCE

Description of photo: At northwest corner of South Broadway/
Belleview intersection, looking southeast towards Black
Eyed Pea Restaurant and portion of Brookridge Shopping.

Date: July 6, 1995 Time: 10:45 am

Witness: None

Direction facing: Southeast Film(35mm) X other



BROADWAY AND BELLEVIEW PCE

Description of photo: At South Broadway curb south of
Meinecke Mufflers, looking southwest towards Harry's
Specialty Cars and Big Dry Creek channel.

Date: July 6, 1995 Time: 10:50 am

Witness: None

Direction facing: Southwest Film(35mm) X other

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APPENDIX 5



Industrial Compliance

Union Tower, 165 South Union Blvd., Suite 1000 Lakewood, CO 80228
303/914-1700 FAX 303/914-1709

PRELIMINARY SITE INVESTIGATION

**CDOT Project No. MRU 0088 (13)
Arapahoe County, Colorado**

IC Project No. 06104692

Prepared For:

**Colorado Department of Transportation
Region 6 - Environmental Section
2000 South Holly Street
Denver, Colorado**

Prepared By:

**Industrial Compliance
165 South Union Boulevard, Suite 1000
Lakewood, Colorado 80228**

April 27, 1995

Denver • Phoenix • Kansas City • Dallas • Houston • Los Angeles • Sacramento • Little Rock • Knoxville



1.0 INTRODUCTION

The Colorado Department of Transportation (CDOT) contracted Industrial Compliance (IC) to conduct a Preliminary Site Investigation (PSI) prior to initiating planned construction activities associated with the Belleview and Broadway intersection expansion project in Englewood, Colorado. CDOT plans to expand the current intersection with the addition of turning lanes. The project will require the acquisition of frontage property along the CDOT right-of-way. The construction plans include limited excavation activities associated with street grading, utility lines, and the removal and/or placement of traffic signal light poles and telephone poles. The PSI was completed as part of the CDOT Project Number MRU 0088 (13).

1.1 Purpose

The purpose of the PSI was to evaluate existing site conditions and the potential for soil and shallow ground-water contamination resulting from previous site usage prior to property acquisition and planned construction activities. The PSI did not include the vertical and horizontal delineation of any contaminants identified during the field program. The study was designed to evaluate what measures will be required during the construction project to mitigate environmental and/or worker health and safety concerns. The study will also assist CDOT in determining what liabilities may be associated with the acquisition of properties along the CDOT right-of-way.

1.2 Background

The PSI field work was based on conversations with Mr. William Carter (CDOT Region 6 Environmental Section) and on the recommendations presented in the Initial Site Assessment (ISA) report conducted by IC, dated October 4, 1994. The ISA revealed service stations, automotive repair shops, and dry cleaning facilities had been located on or near all four corners of the intersection at one time.

A documented release of petroleum hydrocarbons associated with underground storage tanks (USTs) occurred at the Amoco Station located at 5100 South Broadway (southeast corner of the intersection). This release was being remediated by an onsite soil vapor extraction (SVE) system. Thirteen existing ground-water monitor wells are located on or near the Amoco Station property. The existing monitor wells were installed by an independent environmental consultant contracted by the property owner. The water samples collected from the existing monitor wells were analyzed for total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and xylenes (BTEX). No other organic or inorganic constituents were submitted for analysis at the property.

The ISA recommendations were updated in a letter to CDOT dated November 16, 1994. The IC letter recommended conducting a PSI that included the following:

- * Conducting a review of the most recent well sampling data for the Amoco Station site to evaluate the current hydrogeological/environmental status of the site.

- * Preparing a Sampling and Analysis Plan (SAP) of the subject property to supplement current knowledge concerning petroleum compound releases in the area. The SAP would also evaluate if contaminants, in addition to petroleum compounds, have been released in the area. Additional environmental sampling should be conducted, so that potential petroleum compound and hazardous materials/wastes releases be assessed.

A review of the recent well sampling data for the Amoco Station site was conducted by IC, and a SAP was prepared and sent to CDOT in a report dated November 21, 1994. The SAP focused on sampling and analyzing soils and ground water to characterize the presence or absence of hazardous materials beneath the property areas where the intersection expansion activities would be conducted.

1.3 Study Area Description

The site is located at the intersection of Belleview Avenue (Belleview) and South Broadway Boulevard (Broadway) in Englewood, Colorado as shown in Figure 1. The PSI study area extends approximately 300 feet along both sides of Belleview and Broadway as shown in Figure 2. Eleven businesses are located along Belleview Avenue and Broadway Boulevard in the area of the planned CDOT project. The businesses include the Amoco Station, Brookridge Shopping Center, Eskimo Ski Shop, Water Leisure, Star Dry Cleaning, Tune Shop, Vectra Bank, World Savings Bank, Jet Wash, Grease Monkey, and Meineke Muffler. Access agreements were obtained from all the properties for proposed soil borings/monitor well installation, and sampling activities with the exception of the northwest and northeast properties (World Savings Bank and Tune Shop).

2.0 FIELD INVESTIGATION

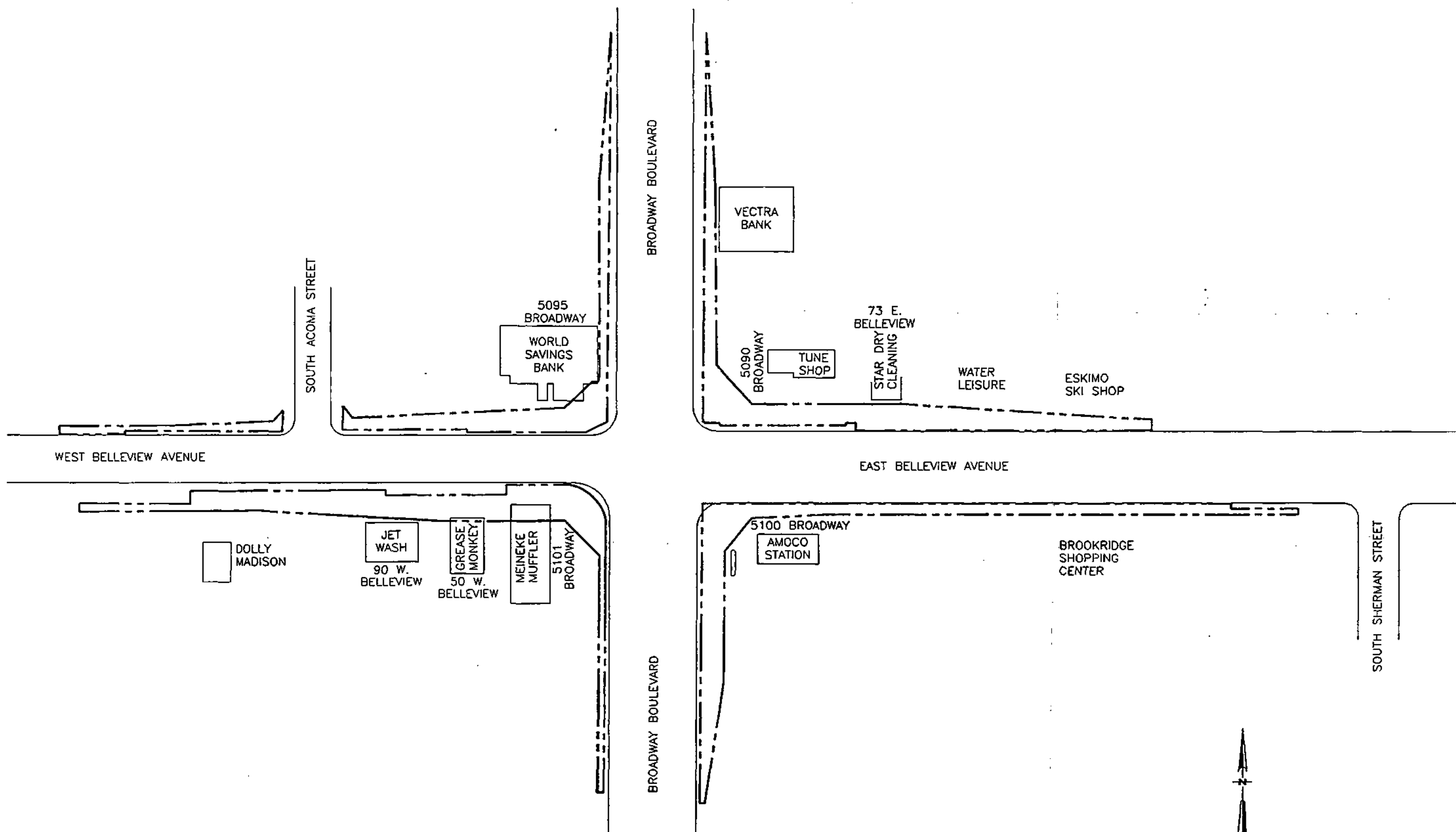
The PSI field investigation was conducted between February 22, 1995 and March 8, 1995. The PSI field activities consisted of a soil boring assessment, monitor well construction, and ground-water sample collection. Figure 3 shows the location of the IC soil borings and ground-water monitoring wells, and the Amoco Station ground-water monitor wells. The field activities associated with the PSI are discussed below.

2.1 Soil Boring Assessment

Eight soil borings (BH-3, BH-4, BH-5, IC-2, IC-3, IC-4, IC-5, and IC-6) were advanced within the study area to assess the potential for soil and shallow ground-water contamination. The SAP proposed eleven soil boring locations as noted in Figure 3, however, proposed soil borings BH-1 and IC-1 (World Savings Bank-5095 South Broadway), and BH-2 (Tune Shop-5090 South Broadway) were not completed since permission to enter those two properties could not be obtained by IC personnel.

Soil borings BH-4 and BH-5 are located adjacent to and downgradient of the auto repair facilities at 50 West Belview (Grease Monkey) and 5101 Broadway (Meineke Muffler) to detect potential petroleum hydrocarbon, solvent, and metal releases from these facilities. Soil boring BH-3 is located at the Amoco Station to detect petroleum hydrocarbon, solvent, and metal releases from this site.





LEGEND:

--- PROPERTY LINE ---



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PROJ.# 06104692

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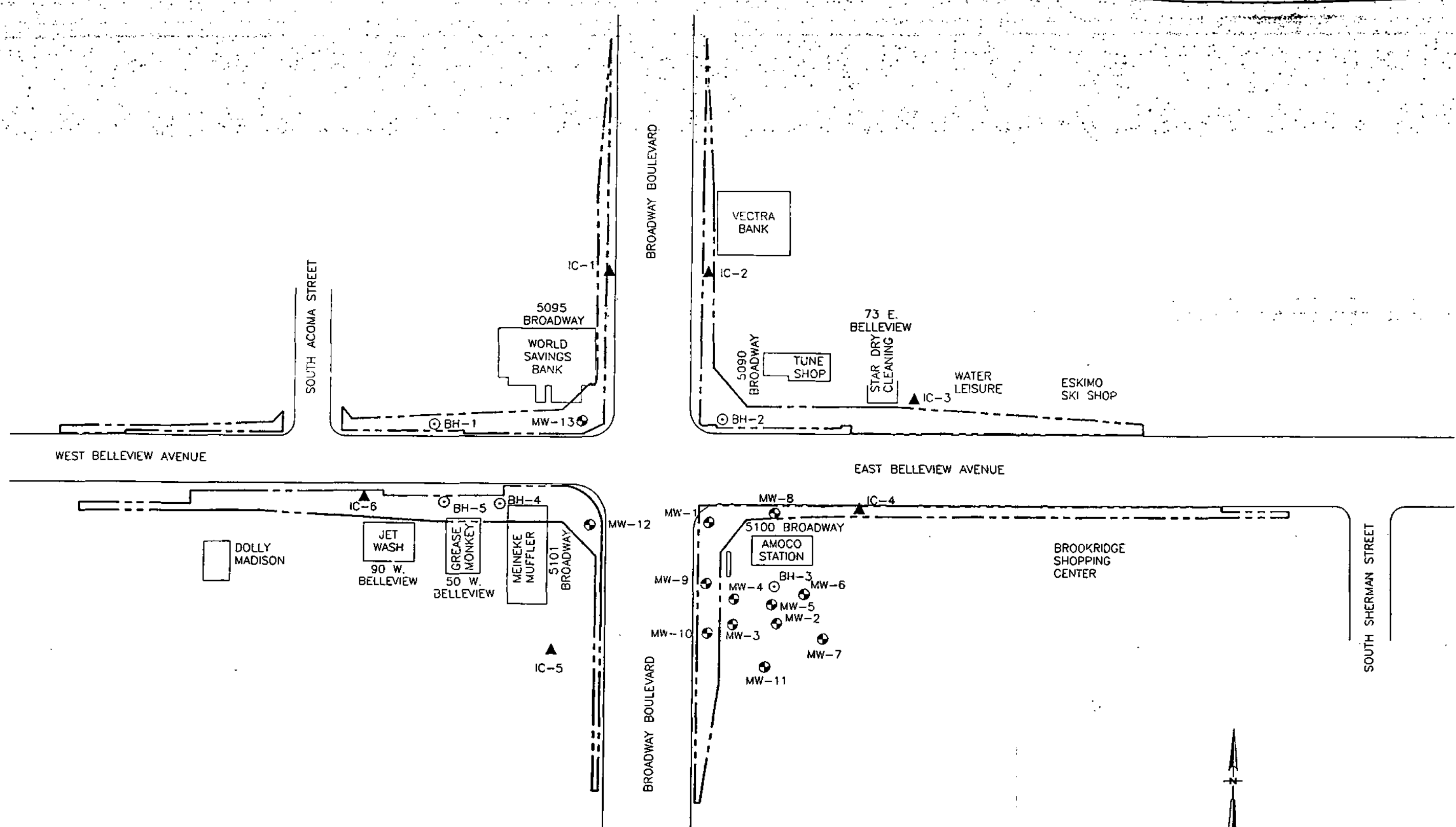
SCALE: AS NOTED

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PAGE#

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FIGURE 2
PROPOSED CDOT RIGHT-OF-WAY LOCATION MAP
COLORADO DEPARTMENT OF TRANSPORTATION
BROADWAY AND BELLEVUE



LEGEND:

- — — — — PROPERTY LINE
- ⊕ EXISTING MONITOR WELL LOCATION
INSTALLED BY AMOCO/CHEVRON
- ▲ IC MONITOR WELL LOCATION
- ⊙ IC BOREHOLE LOCATION

NOTE: DUE TO PROPERTY ACCESS AGREEMENT PROBLEMS,
BOREHOLES BH-1, BH-2, AND IC-1 WERE NOT
COMPLETED DURING THIS PSI.



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PROJ. # 06104692	DRAWN BY: JEG
FILE NO. 4649F3	SCALE: AS NOTED
DATE: 9/30/94	PAGE: 1
REVISED:	

FIGURE 3
SAMPLE LOCATION MAP
COLORADO DEPARTMENT OF TRANSPORTATION
BROADWAY AND BELLEVUE

Soil boring IC-2 is located downgradient of the Amoco Station and Tune Shop facilities to detect potential petroleum hydrocarbon and solvent releases from these sites. Soil boring IC-2 is also located downgradient of the Star Dry Cleaning facility located at 73 East Bellevue to detect potential solvent releases from this site. Soil boring IC-3 is located adjacent to the Star Dry Cleaning facility. Soil boring IC-4 is located cross-gradient from the known petroleum hydrocarbon release located at the Amoco Station to verify the lateral extent of this release. Soil boring IC-5 is located on the Meineke Muffler property located at 5101 Broadway to evaluate petroleum hydrocarbon or solvent releases from this facility. Soil boring IC-6 is located downgradient from the auto repair facility and cleaning facility located at 50 West Bellevue (Grease Monkey) and 90 West Bellevue (Jet Wash) to detect potential petroleum hydrocarbon and solvent releases from these facilities.

The soil borings were advanced using a CME-75 drill rig equipped with 8-inch diameter, hollow-stem augers. A 24-inch long, 1.5-inch diameter split-spoon sampler, or a 60-inch long, 3.0-inch diameter continuous sampler, were utilized to collect discrete soil samples at approximate five-foot intervals in each soil boring. All drilling and sampling equipment was cleaned using a high pressure steam cleaner prior to use in each soil boring. Auger cuttings were placed in steel 55-gallon drums. Each drum was properly marked as to the origin of the soil cuttings. These drums are currently being stored offsite at the CDOT maintenance facility located at Interstate 76 and Federal Boulevard until final disposal options are reviewed with CDOT.

The soil samples and auger cuttings were visually examined for lithology and evidence of staining in the field by the IC Geologist. Lithology was logged in accordance with the Unified Soil Classification System. In addition, the soil samples and auger cuttings were continuously monitored during the sampling program for organic vapors using a Thermo Environmental Instruments, Inc. Model 580B portable photoionization detector (PID). The

PID was equipped with a 10.9-ionization potential Ev lamp that provides the sensitivity necessary to identify the organic compounds previously detected at the site. The PID provides quantitative analysis of ionizable organic compound concentrations in air and gives a direct readout in parts per million (ppm). This instrument determines the concentration of total ionizable organic compounds but does not differentiate between specific compounds. The operational range of the PID is 0 to 2,000 ppm, with a minimum instrument detection of 0.1 ppm. Headspace PID field screening was conducted on all soil samples. The soil samples were placed in resealable polyethylene bags and allowed to warm to ambient temperature. The tip of the PID was placed in the bag and the highest reading was recorded. The lithologic descriptions and PID observations were recorded on the original field drilling logs and presented in Appendix A.

Soil borings BH-3, BH-4, and BH-5 were advanced to a depth of 9 to 10.5-feet below the ground surface (bgs). This depth interval was based on the anticipated maximum depth required for any utility re-routing excavations. One shallow (alluvium) soil sample was collected from each of these soil boring locations for laboratory analysis. Each soil sample was collected from the base of the soil boring unless observed stained soil conditions or field PID screening indicated other intervals were more appropriate. The soil sample collected from soil boring BH-5 (0.3 to 1.5-feet bgs) was selected based on observed stained soil conditions.

Soil borings BH-3, BH-4, and BH-5 were abandoned (backfilled) with granular bentonite from the base of each boring to one foot below the ground surface. A grout/sakrete slurry was placed in the upper one foot of each boring to complete repair of the existing concrete or asphalt pavement.

Soil borings IC-2, IC-3, IC-4, IC-5, and IC-6 were advanced to a depth of 20 to 24.3-feet bgs. Each of these soil borings were advanced into bedrock. Depth to bedrock varied from 13.5-feet bgs (IC-6) to 22-feet bgs (IC-3). One shallow (alluvium) soil sample was collected

for laboratory analysis from the 9 to 10.5-foot interval in each soil boring unless observed stained soil conditions or field PID readings indicated other intervals were more appropriate.

The shallow soil sample collected from soil boring IC-3 (14 to 15.5-feet) was selected based on a slightly elevated PID reading. In addition, one subsurface (bedrock) soil sample was collected for laboratory analysis from each soil boring. Each subsurface soil boring was collected from the alluvium/bedrock interface or weathered bedrock interval.

The shallow soil samples and subsurface soil samples were placed directly into EPA-approved glass containers supplied by the contract laboratory. The samples were labeled with the sample location, date and time of sample collection, samplers's name, and required analysis. Immediately, upon collection, the samples were placed in a cooler filled with ice. Chain-of-custody (COC) forms were completed and transported with the samples to the contract laboratory.

Two equipment blank samples were collected from the soil sampling equipment. Equipment blank sample EB-1 was collected from the stainless steel split-spoon sampler and equipment blank sample EB-2 was collected from the stainless-steel continuous sampler. The purpose of the equipment blank samples was to determine if the decontamination procedure is effective. The sampling equipment was decontaminated by washing the sampling equipment withalconox soap and a stiff brush followed by a potable water rinse and distilled water rinse. The equipment blank samples were collected by pouring distilled water over the clean sampling equipment and into the glass containers proved by the contract laboratory. The equipment blank samples were then delivered to the laboratory along with the soil samples selected for analyses.

2.2 Ground-Water Assessment

2.2.1 Monitor Well Installation

Soil borings IC-2 through IC-6 were completed as ground-water monitor wells. The location of these ground-water monitoring wells are shown in Figure 3. The monitor wells were completed into bedrock at depths ranging from 20 to 24.3-feet bgs. The monitor wells were designed to monitor the shallow alluvial aquifer which may be present above the alluvium/bedrock contact.

The ground-water monitoring wells were constructed with 2-inch diameter, threaded, flush-jointed, schedule 40 polyvinyl chloride (PVC) casing. A 10-foot section of 0.020-inch slotted-screen fitted with a bottom cap was placed at the base of each soil boring, and blank casing placed from the screened interval to the surface. The objective of the screened interval lengths were to span the ground-water table allowing for seasonal fluctuations. The annular space from the base of the well to approximately two feet above the screened interval of the well was filled with 8/12 graded silica sand. A bentonite seal was placed from the top of the sand pack to approximately one foot from the ground surface and hydrated with tap water. Above the bentonite, a grout/sakrete mixture was poured to the ground surface. A steel, flushmount well protector was placed over the PVC casing for protection. A locking cap was placed on the top of the PVC casing. Each monitor well was locked with keyed-alike padlocks. Copies of the monitoring well completion forms are included in Appendix B.

2.2.2 Monitor Well Ground-Water Sample Collection

Less than one foot of water was present in ground-water monitoring wells IC-2 through IC-6 after a two week timeframe, therefore these monitor wells could not be sampled.

A total of thirteen monitor wells were associated with the Amoco Station facility located on the southeast corner of the Belleview and Broadway intersection at 5100 South Broadway. The thirteen monitor wells were installed by an independent environmental consultant contracted by the property owner and are associated with the known petroleum hydrocarbon release at this property. These monitor wells were apparently completed into the bedrock formation water of the Denver Formation. The monitor well screened intervals were placed to monitor the shallow alluvial aquifer and/or bedrock formation water. Seven of the Amoco ground-water monitoring wells (MW-1, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-13) were sampled on March 7 and March 8, 1995. The location of the Amoco monitor wells are shown on Figure 3. Monitor well MW-11 is located upgradient of the Amoco Station, while monitor wells MW-12 and MW-13 are located downgradient of the Amoco Station. Total depth of the seven existing monitor wells selected for ground-water sample collection ranged from 37.80-feet bgs (MW-9) to 48.90-feet bgs (MW-1).

The ground-water monitor wells were purged and sampled using a 1.5-inch diameter PVC bailer. Three annular casing volumes of water were removed from each of the seven monitor wells. In addition, the purged water was tested for pH, temperature, and specific conductance after the removal of each casing volume to ensure that the ground-water samples were representative of the formation water. Copies of the ground-water monitoring data sheets are provided in Appendix C. The purged water was visually examined for light non-aqueous phase liquids (LNAPLs) and placed in one steel 55-gallon drum. This drum is being stored offsite at the CDOT maintenance facility located at 5807 North Federal Boulevard until final disposal options are reviewed with CDOT.

The PVC bailer was cleaned with a non-phosphate type soap and triple rinsed with distilled water before use in each monitor well. In addition, a new section of nylon rope was attached to the PVC bailer before purging and sampling of each monitoring well to minimize the potential for cross-contamination between monitor wells. The ground-water was poured from the PVC bailer directly into the sample containers supplied and prepared by the contract laboratory. The sample containers were labeled with the sample location, date and time of sample collection, samplers's name and required analysis. Immediately after collection, the samples were placed in a cooler filled with ice and delivered to the laboratory. A COC form was completed and transported with the sample cooler.

3.0 LABORATORY ANALYSIS

Soil and ground-water sample analysis was conducted by Evergreen Analytical, Inc. (Evergreen), located in Wheat Ridge, Colorado. Table 1 presents a summary of all soil and ground-water samples submitted for laboratory analysis including sample location, sample interval, and type of analyses performed. A complete copy of the soil and ground-water laboratory results is included in Appendix D.

The eight shallow (alluvium) soil samples collected from soil borings BH-3, BH-4, BH-5, and IC-2 through IC-6 were submitted for analysis of volatile organic compounds (VOCs) by EPA Method 8260, semi-volatile organic compounds (SVOCs) by EPA Method 8270, total extractable petroleum hydrocarbons (TEPH) by modified EPA Method 8015, polychlorinated biphenyls (PCBs) by EPA Method 8080, and the 13 priority pollutant total metals by EPA Methods outlined in SW-846.

The five subsurface (bedrock) soil samples collected from soil borings IC-2 through IC-6 were submitted for analysis of SVOCs, TEPH, and the 13 priority pollutant total metals.

Equipment blank samples EB-1 and EB-2 were collected from the soil sampling equipment. These two samples were submitted for analysis of VOCs by EPA Method 8260. One trip blank was also submitted for VOC analysis.

Ground-water samples collected from the seven Amoco monitor wells MW-1, and MW-8 through MW-13 were submitted for analysis of VOCs by EPA Method 8260, SVOCs by EPA Method 8270, TEPH by modified EPA Method 8015, and the 13 priority pollutant dissolved metals by EPA Methods 600/4-79-020.

TABLE 1

SAMPLE IDENTIFICATION AND LABORATORY ANALYSES PERFORMED

Sample Location	Sample Matrix	Interval	VOCs	SVOCs	TEPH	PCBs	Metals
BH-3	Soil	8'-9'	X	X	X	X	X
BH-4	Soil	8'-9'	X	X	X	X	X
BH-5	Soil	0.3'-1.5'	X	X	X	X	X
IC-2	Soil	9'-10.5'	X	X	X	X	X
IC-2	Soil	19'-20.5'		X	X		X
IC-3	Soil	14'-15.5'	X	X	X	X	X
IC-3	Soil	22.5'-24'		X	X		X
IC-4	Soil	9'-10.5'	X	X	X	X	X
IC-4	Soil	23'-24'		X	X		X
IC-5	Soil	9'-10.5'	X	X	X	X	X
IC-5	Soil	14'-15.5'		X	X		X
IC-6	Soil	9'-10.5'	X	X	X	X	X
IC-6	Soil	14'-15.5'		X	X		X
EB-1	Water		X				
EB-2	Water		X				
Trip Blank	Water		X				
MW-1	Water		X	X	X		X
MW-8	Water		X	X	X		X
MW-9	Water		X	X	X		X
MW-10	Water		X	X	X		X
MW-11	Water		X	X	X		X
MW-12	Water		X	X	X		X
MW-13	Water		X	X	X		X

4.0 RESULTS AND DISCUSSIONS

4.1 Field Results

4.1.1 Soil Boring Assessment

No soil staining or unusual odors were noted in the shallow soil samples or subsurface soil samples with the exception of sample BH-5 (0.3-1.5'). Shallow soil sample BH-5 was collected from obviously stained soils near the Grease Monkey and Meineke Muffler properties. However, no elevated PID reading or petroleum odor was detected from this sample. In addition, no obviously stained soils, elevated PID readings, or petroleum odors were noted below 1.5-feet bgs in this soil boring.

PID readings obtained from the shallow soil samples and subsurface soil samples ranged from less than 1 ppm to a maximum of 4 ppm with the exception of shallow soil sample IC-3 (14-15.5') which exhibited a PID reading of 14 ppm. However, no soil staining or petroleum odor was detected from this sample.

Soil borings BH-3, BH-4, and BH-5 were advanced to a depth of 9 to 10.5-feet bgs. Soil borings IC-2, IC-3, IC-4, IC-5, and IC-6 were advanced to a depth of 20 to 24.3-feet bgs. Soil borings IC-2 through IC-6 were advanced into bedrock. Depth to bedrock varied from 13.5-feet bgs (IC-6) to 22-feet bgs (IC-3).

Soils encountered in the eight soil borings were composed primarily of a brown, clayey sand (fine grained to coarse grained) and sandy clay from the ground surface to the bedrock contact. Bedrock consisted of a olive-brown to reddish-brown, clayey to very clayey, fine grained to medium grained sandstone (Denver Formation).

4.1.2 Ground-Water Assessment

Seven Amoco ground-water monitoring wells (MW-1, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-13) were sampled on March 7 and March 8, 1995. Bedrock formation water was encountered in all existing monitor wells at depths ranging from 33.05-feet bgs (MW-11) to 35.91-feet bgs (MW-13). No LNAPLs or dense non-aqueous phase liquids (DNAPLs) were noted in the ground water purged from the existing wells. However, a petroleum odor and dark gray water color were noted in the purge water collected from monitor well MW-9.

New monitor wells IC-2 through IC-6 and the seven Amoco ground-water monitor well (sampled on March 7-8, 1995) locations and elevations were surveyed by a professional surveyor. The survey information was used to determine a ground-water (bedrock formation water) flow direction. The local ground-water (bedrock formation water) flow direction is estimated to be from the southeast to the northwest (North 12 to 25 degrees West) based on water elevations obtained from the Amoco ground-water monitor wells (March 7, 1995) and the monitor well rim elevations obtained by the professional surveyor. The ground-water (bedrock formation water) flow direction calculations and survey data is included in Appendix E.

IC reviewed several of the existing monitor well completions logs at the Amoco Station in an effort to determine whether the ground water present in the existing wells represented the shallow alluvial aquifer, the bedrock formation aquifer, or both. The penetration depths of the existing monitor wells into bedrock (Denver Formation), screened intervals, and the depth to ground water, indicate the ground water present in the Amoco monitor wells are representative of the bedrock formation aquifer.

4.2 Analytical Results

4.2.1 Soil Sample Results

Eight shallow (alluvial) soil samples (BH-3 8-9', BH-4 8-9', BH-5 0.3-1.5', IC-2 9-10.5', IC-3 14-15.5', IC-4 9-10.5', IC-5 9-10.5', and IC-6 9-10.5') and five subsurface (bedrock) soil samples (IC-2 19-20.5', IC-3 22.5-24', IC-4 23-24', IC-5 14-15.5', and IC-6 14-15.5') were submitted for organic and inorganic laboratory analyses. These laboratory analyses were performed to evaluate the presence or absence of organic and/or inorganic compounds in the surface and subsurface soils. A discussion of analytical results for the shallow soil samples and the subsurface soil samples is presented below.

4.2.1.1 VOCs

No VOCs were detected above the laboratory practical quantitation limit (PQL) in the eight shallow soil samples submitted for analysis. However, two VOCs (acetone and chloroform) were identified below the laboratory PQL. The VOCs identified in the soil samples are summarized in Table 2. Acetone was identified below the laboratory PQL of 110 to 120 parts per billion (ppb) in six soil samples. The acetone concentrations ranged from 13 ppb (BH-4 8-9') to 74 ppb (BH-5 0.3-1.5'). However, acetone was also identified in the laboratory method blank. Chloroform was identified below the laboratory PQL of 5 ppb in soil sample BH-4 (8-9') at a concentration of 1 ppb. Acetone and chloroform are common laboratory contaminants.

TABLE 2

SOIL ORGANIC COMPOUND ANALYTICAL RESULTS

Parameter	Sample Location						
	BH-3 (8'-9')	BH-4 (8'-9')	BH-5 (0.3'-1.5')	IC-2 (9'-10.5')	IC-3 (14'-15.5')	IC-4 (9'-10.5')	IC-6 (9'-10.5')
VOCs:							
Acetone	16 BJ	13 BJ	74 BJ	19 BJ	17 BJ	15 BJ	19 BJ
Chloroform	U	1 J	U	U	U	U	U
SVOCs:							
bis (2-Ethylhexyl) Phthalate	U	U	U	U	22 J	23 J	U
Phenanthrene	U	U	42 J	U	U	U	U
Fluoranthene	U	U	90 J	U	U	U	U
Pyrene	U	U	130 J	U	U	U	U
Benzo(a)Anthracene	U	U	54 J	U	U	U	U
Chrysene	U	U	74 J	U	U	U	U
Benzo(b)Fluoranthene	U	U	73 J	U	U	U	U
Benzo(a)Pyrene	U	U	51 J	U	U	U	U
Indeno(1,2,3-cd) Pyrene	U	U	31 J	U	U	U	U
Benzo(g,h,i)Perylene	U	U	32 J	U	U	U	U

Notes: VOC and SVOC results reported in ppb

J = estimated value below the PQL

B = compound detected in blank sample

U = compound not detected

4.2.1.2 SVOCs

All thirteen shallow and subsurface soil samples were analyzed for SVOCs. No SVOCs were detected above the laboratory PQL. However, nine SVOCs (phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene) were identified below the laboratory PQL of 550 ppb in sample BH-5 (0.3-1.5') at concentrations ranging from 31 ppb to 130 ppb. This soil sample was collected from obviously stained soils in this interval. However, no elevated PID reading or petroleum odor was detected in this sample. The identified SVOCs are derivatives of coal tar, which are commonly used for roofing tar and asphalt pavement material. The SVOCs identified in the soil samples are summarized in Table 2. SVOC bis(2-ethylhexyl)phthalate was identified below the laboratory PQL of 400 ppb in two soil samples. The bis(2-ethylhexyl)phthalate concentrations ranged from 22 ppb (IC-3 14-15.5') to 23 ppb (IC-4 9-10.5'). Bis(2-ethylhexyl)phthalate is a liquid associated with laboratory vacuum pumps used in analytical chemistry.

4.2.1.3 TEPH

All thirteen shallow and subsurface soil samples were analyzed for TEPH. TEPH was detected above the laboratory method detection limit (MDL) of 10 ppm in soil sample IC-4 (9-10.5') at a concentration of 14 ppm. TEPH was not identified in the other twelve soil samples.

4.2.1.4 PCBs

The eight shallow soil samples (BH-3 8-9', BH-4 8-9', BH-5 0.3-1.5', IC-2 9-10.5', IC-3 14-15.5', IC-4 9-10.5', IC-5 9-10.5', and IC-6 9-10.5') were analyzed for PCBs. No PCBs were detected above the laboratory PQL in any of these samples.

4.2.1.5 Priority Pollutant Metals

All thirteen shallow and subsurface soil samples were analyzed for the thirteen priority pollutant metals. The metal results are compared with the EPA SW-874 common soil range values in Table 3. The total metal results are all within the EPA SW-874 common soil range values with several exceptions. Mercury was detected at a concentration of 0.6 ppm in soil sample IC-6 (14-15.5') which is above the maximum common range value of 0.3 ppm. Cadmium was detected in soil samples IC-5 (14-15.5'), BH-4 (8-9'), and BH-5 (0.3-1.5') at a concentration of 1.1 ppm, 1.4 ppm, and 2.6 ppm, respectively. These cadmium concentrations are above the maximum common range value of 0.7 ppm. Copper was detected at a concentration of 110 ppm in soil sample IC-2 (9-10.5') which is slightly above the maximum common range value of 100 ppm. Silver was detected in eight soil samples at concentrations ranging from 6.3 ppm (BH-4 8-9') to 16 ppm (IC-4 23-24') which are slightly above the maximum common range value of 5 ppm. The slightly elevated metal concentrations present in the soil samples may be the result of naturally occurring metals associated with the alluvial or bedrock deposits.

TABLE 3

SOIL PRIORITY POLLUTANT METAL RESULTS

Priority Pollutant Metal	Sample Location													EPA SW-874 Soil Common Range Values
	BII-3 (8'-9')	BII-4 (8'-9')	BII-5 (0.3'-1.5')	IC-2 (9'-10.5')	IC-2 (19'-20.5')	IC-3 (14'-15.5')	IC-3 (22.5'-24')	IC-4 (9'-10.5')	IC-4 (23'-24')	IC-5 (9'-10.5')	IC-5 (14'-15.5')	IC-6 (9'-10.5')	IC-6 (14'-15.5')	
Antimony	<6.9	<6.9	<6.9	<6.9	<6.9	9.2	<6.9	<6.9	<6.9	<6.9	<6.9	<6.9	<6.9	2-10
Arsenic	19	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	14	<12	1-50
Beryllium	0.63	0.72	0.46	0.57	0.7	2.4	0.7	0.59	0.9	1.4	7.3	1.7	3.7	0.1-40
Cadmium	<0.5	1.4	2.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	0.5	0.01-0.7
Chromium	12	10	8.1	10	7.8	13	7.0	11	7.9	7.7	6.5	7.7	7.0	1-1,000
Copper	20	16	35	110	19	18	17	20	17	11	14	10	21	2-100
Lead	<5.5	<5.5	16	<5.5	11B	<5.5	20B	<5.5	21B	<5.5	29B	<5.5	18B	2-200
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.6	0.01-0.3
Nickel	6.1	8.2	10	7.2	<4	11	<4	10	<4	11	4	7.4	4	5-500
Selenium	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	0.1-2
Silver	10	6.3	<2.1	7.9	15	8.7	14	<2.1	16	<2.1	14	5.1	14	0.01-5
Thallium	<8	<8	<8	8.7	11	<8	<8	<8	<8	<8	11	<8	<8	
Zinc	59	40	100	65	24	65	90	75	100	40	72	46	99	10-300

Notes: All results reported in parts per million (ppm)

< = less than

B = element detected in reagent blank

--- = common range value not established

Shaded areas indicate metals above the common range values

4.2.1.6 Equipment and Trip Blanks

Two equipment blank samples (EB-1 and EB-2) and one trip blank sample were analyzed for VOCs. Toluene was the only VOC identified above the laboratory PQL in the equipment and trip blanks. Toluene was identified in equipment blank EB-1 at a concentration of 10 ppb. Three VOCs (acetone, methylene chloride, and 1,1,1-trichloroethane) were identified in the equipment or trip blank samples at concentrations below the laboratory PQL. Acetone was identified below the laboratory PQL of 100 ppb in samples EB-1, EB-2, and the trip blank, at a concentration of 33 ppb, 35 ppb, and 33 ppb, respectively. Methylene chloride and 1,1,1-trichloroethane were identified below the laboratory PQL of 5 ppb in sample EB-2 at a concentration of 1 ppb. Acetone and methylene chloride are common laboratory contaminants used for cleaning laboratory equipment and sample containers. Toluene and 1,1,1-trichloroethane probably originated from local businesses or traffic emissions and dust from the Bellevue and Broadway intersection since these two VOCs were not identified in any of the thirteen soil samples submitted for analyses. The equipment and trip blank results indicate that the sampling equipment decontamination procedures were effective.

4.2.2 Ground-Water Results

Seven ground-water (bedrock formation water) samples collected from the Amoco monitor wells (MW-1 and MW-8 through MW-13) were submitted for organic and inorganic laboratory analyses. These laboratory analyses were performed to evaluate the presence or absence of organic and/or inorganic compounds in the ground water. A discussion of analytical results for the ground-water samples is presented on the following pages.

4.2.2.1 VOCs

Several VOCs were detected in Amoco ground-water samples MW-1, MW-8, MW-9, MW-10, MW-12, and MW-13 above the laboratory PQL. Tetrachloroethene (PCE) was detected above the laboratory PQL in ground-water samples MW-1, MW-8, MW-9, MW-10, MW-12, and MW-13 at concentrations ranging from 20 ppb (MW-12) to 2,400 ppb (MW-8). The PCE concentrations and PCE concentration contours are presented on Figure 4.

Trichloroethene (TCE) was detected above the laboratory PQL in ground-water samples MW-1, MW-8, and MW-13 at concentrations ranging from 12 ppb (MW-1) to 25 ppb (MW-8). 1,2-dichloroethane (1,2-DCA) was detected above the laboratory PQL in ground-water samples MW-1, MW-8, and MW-13 at concentrations ranging from 1 ppb (MW-1 and MW-13) to 54 ppb (MW-8). VOCs identified below the laboratory PQL include benzene, chloromethane, cis 1,2-dichloroethene (cis 1,2-DCE), 1,2-DCA, TCE, and acetone. PCE, TCE, 1,2-DCA, benzene, chloromethane, and cis 1,2-DCE are compounds commonly used at service stations/automotive repair shops for metal degreasers and cleaning brake parts, and as a dry cleaning solvent at dry cleaning facilities. Cis 1,2-DCE and 1,2-DCA are also byproducts of PCE and TCE. The VOCs identified below the laboratory PQL ranged in concentration from 1 ppb to 140 ppb. The VOCs identified in the ground-water samples are summarized in Table 4.

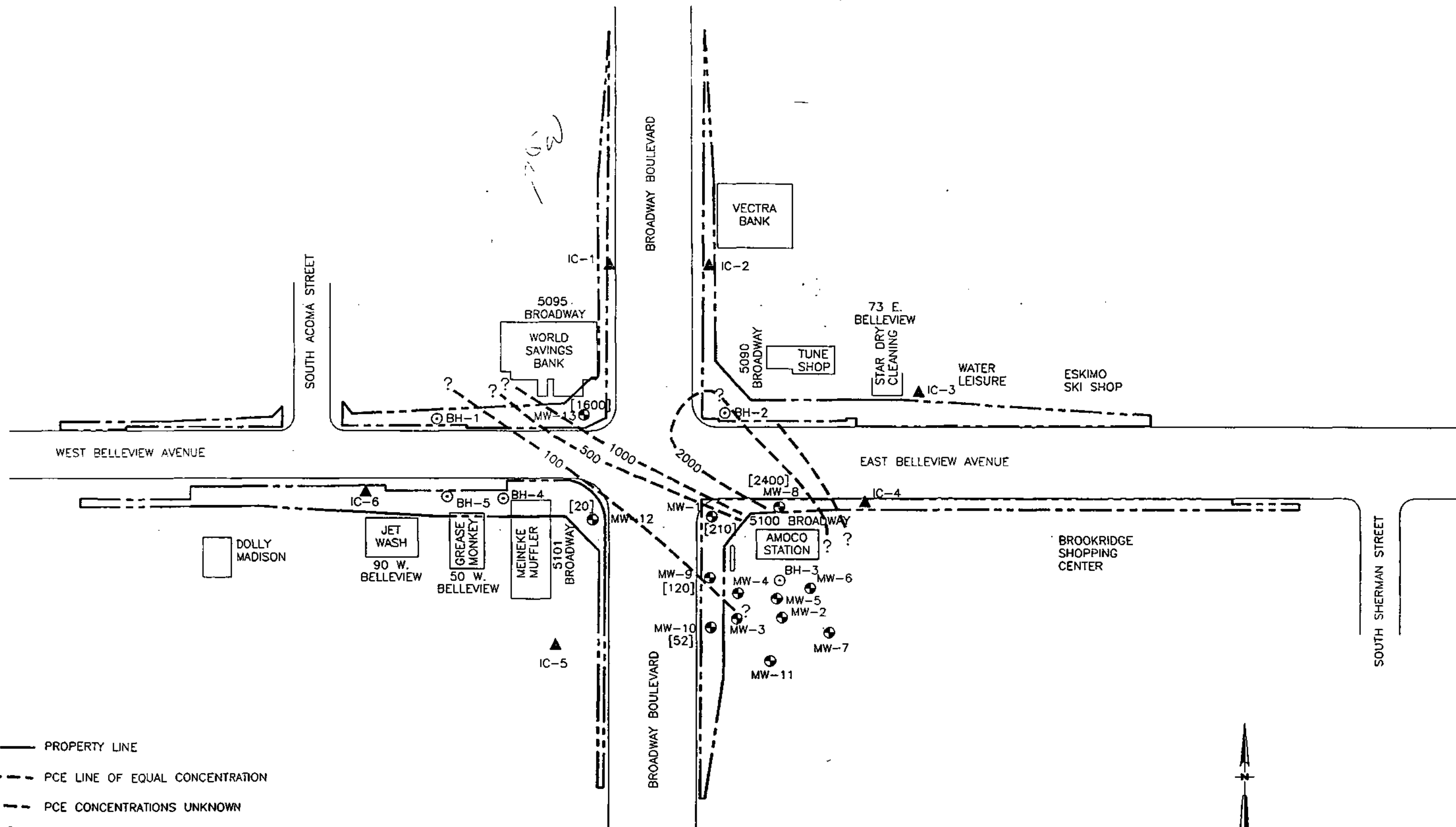
The VOCs identified in ground-water samples were compared with the Colorado Ground-Water Standards (CGWS). The PCE, TCE, and/or 1,2-DCA concentrations present in ground-water samples collected from Amoco monitor wells MW-1, MW-8, MW-9, MW-10, MW-12, and MW-13 are above the CGWS. These results indicate that the ground-water samples tested at the site have been significantly impacted by VOCs.

TABLE 4

GROUND-WATER ORGANIC COMPOUND RESULTS

Parameter	Sample Location							CGWS
	MW-1	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	
VOCs:								
Acetone	U	140 BJ	19 J	13 J	17 J	U	12 J	NE
Benzene	1 J	U	2 J	1 J	U	U	U	5 mg/L
Chloromethane	2 J	U	U	2 J	U	U	2 J	NE
1,2-Dichloroethane <i>5 ppb</i>	1 J	54 -	U	U	U	U	1 J	0.4 mg/L
cis 1,2-Dichloroethene	2 J	U	U	U	U	U	7	70
Tetrachloroethene <i>5 ppb</i>	210	2,400	120	52	U	20	1,600	5 <i>5 ppb</i>
Trichloroethene <i>TCF 5 ppb</i>	12	25 J	2 J	1 J	U	1 J	22	5
SVOCs:								
Naphthalene	U	U	1 J	U	U	U	U	NE
4-Methylphenol	U	U	U	U	U	1 J	U	NE
bis(2-Ethylhexyl)Phthalate	U	U	U	U	U	1 JB	1 JB	6

Notes: All results reported in parts per billion (ppb)
 J = estimated value below the laboratory PQL
 B = compound detected in blank sample
 U = compound not detected
 CGWS = Colorado Ground-Water Standards
 NE = CGWS not established for this compound
 Shaded areas indicate VOC's above the CGWS



LEGEND:

- — — — — PROPERTY LINE
- 1000- - - - - PCE LINE OF EQUAL CONCENTRATION
- ? - - - - - PCE CONCENTRATIONS UNKNOWN
- [2400] PCE CONCENTRATION IN PPB AT MONITOR WELL
- MW-8 ● EXISTING MONITOR WELL LOCATION INSTALLED BY AMOCO/CHEVRON AND
- ▲ IC MONITOR WELL LOCATION
- IC BOREHOLE LOCATION

NOTE: DUE TO PROPERTY ACCESS AGREEMENT PROBLEMS, BOREHOLES BH-1, BH-2, AND IC-1 WERE NOT COMPLETED DURING THIS PSI.



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APPROXIMATE SCALE (FEET)

FIGURE 4
PCE CONCENTRATION MAP
COLORADO DEPARTMENT OF TRANSPORTATION
BROADWAY AND BELLEVUE

4.2.2.2 SVOCs

No SVOCs were detected in the ground-water samples above the laboratory PQL. SVOCs bis(2-ethylhexyl)phthalate, naphthalene, and/or 4-methylphenol were detected below the laboratory PQL in existing monitor wells MW-9, MW-12, and MW-13 at a concentration of 1 ppb. It should be noted that bis (2-ethylhexyl) phthalate was also detected in the laboratory method blank at a concentration of 1 ppb. The SVOCs identified in the ground-water samples are summarized in Table 4. The CGWS standard for bis(2-ethylhexyl)phthalate is 6 ppb. Bis(2-ethylhexyl)phthalate is a common laboratory contaminate. No CGWS have been determined for naphthalene and 4-methylphenol.

4.2.2.3 TEPH

TEPH was detected in ground-water sample MW-9 at a concentration of 0.5 ppm. TEPH was not detected in any of the other ground-water samples submitted for analysis.

4.2.2.4 Priority Pollutant Metals

All ground-water samples were analyzed for the thirteen priority pollutant dissolved metals. The metal results are compared with the CGWS in Table 5. The dissolved metal results are all within the CGWS with the exception of cadmium. Cadmium was detected in five ground-water samples (MW-8, MW-9, MW-10, MW-11, and MW-13) at concentrations ranging from 0.007 ppm (MW-9) to 0.016 ppm (MW-10). These cadmium concentrations are above the CGWS of 0.005 ppm. However, it should be noted that cadmium was detected in upgradient monitor well MW-11 at a concentration of 0.012 ppm, which may indicate that the cadmium concentrations are indicative of naturally occurring conditions in the bedrock ground water.

TABLE 5
GROUND-WATER PRIORITY POLLUTANT METAL RESULTS

Priority Pollutant Metal	Sample Location							CGWS
	MW-1	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	
Antimony	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	0.006
Arsenic	<0.0018	<0.0018	0.002	<0.0018	<0.0018	<0.0018	<0.0018	0.05
Beryllium	<0.001B	<0.001B	<0.001B	<0.001B	<0.001B	<0.001B	<0.001	0.004
Cadmium	<0.005	0.012	0.007	0.016	0.012	<0.005	0.011B	0.005
Chromium	<0.0016B	<0.0016B	<0.0016B	<0.0016B	0.018B	<0.0016B	<0.016	0.05
Copper	0.010	0.008	0.006	0.0047	0.0052	0.0033	<0.003B	1.0
Lead	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	0.05
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002
Nickel	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	0.1
Selenium	<0.0039	<0.0039	<0.0039	<0.0039	0.0097	<0.0039	<0.0039	0.01
Silver	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	0.05
Thallium	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	0.002
Zinc	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	5.0

Notes: All results reported in parts per million (ppm)
 < = less than
 B = element detected in reagent blank
 CGWS = Colorado Ground-Water Standard
 Shaded areas indicate metals above the CGWS

5.0 SUMMARY AND CONCLUSIONS

This PSI was conducted at the intersection of Bellevue Avenue and South Broadway Boulevard in Englewood, Colorado. The PSI field work was based on conversations with Mr. William Carter (CDOT Region 6 Environmental Section) and on the recommendations presented in the ISA report conducted by IC (dated November 16, 1994). The PSI studied specific areas identified in the ISA report as having a high risk potential for environmental problems, liabilities, or exposure hazards for workers. The PSI field work consisted of a soil boring assessment, monitor well construction, and a ground-water assessment along the CDOT Right-Of-Way on both sides of Bellevue Avenue and South Broadway Boulevard.

No other areas within the CDOT right-of-way were investigated during this study. The PSI did not include delineating the vertical or horizontal extent of any contaminated soils or ground-water identified during the field program. Specific conclusions were based upon the field observations and analytical results of this study. It is possible that additional sampling and analysis within the study area could alter these conclusions. It should be noted that proposed soil borings BH-1 and IC-1 (World Savings Bank), and BH-2 (Tune Shop) were not completed since permission to enter those two properties could not be obtained by IC personnel. The conclusions are summarized below.

5.1 Soil Boring Assessment

Eight soil borings (BH-3, BH-4, BH-5, IC-2, IC-3, IC-4, IC-5, and IC-6) were advanced within the study area to assess the potential for soil and/or ground-water contamination. A total of thirteen shallow (alluvium) and subsurface (bedrock) soil samples were collected from the eight soil boring locations across the site.

Soil borings BH-3, BH-4, and BH-5 were advanced to a depth of 9 to 10.5-feet bgs. Soil borings IC-2 through IC-6 were advanced into bedrock. Depth to bedrock varied from 13.5-feet bgs (IC-6) to 22-feet bgs (IC-3).

No VOCs, SVOCs, or PCBs were detected in any of the soil samples above the respective laboratory PQLs. However, it should also be noted that low concentrations of SVOCs were identified in soil boring BH-5 (0.3-1.5') at a concentration below the laboratory PQL. The identified SVOCs are derivatives of coal tar, which are commonly used for roofing tar and asphalt pavement material. The SVOCs identified are polycyclic aromatic hydrocarbons (PAHs). PAHs are known or suspected carcinogenic compounds in their pure form. PAHs are quite stable compounds and are pervasive in the environment as a result of both natural and manmade processes. They exhibit low volatility and low aqueous solubility. Due to the hydrophobic character of these compounds, they exhibit a strong tendency to adsorb onto soils. Such adsorption often plays a major role in the transport and fate of these compounds in the environment. PAH-contaminated soils are not RCRA hazardous wastes and are not, therefore, subject to RCRA's subtitle C disposal requirements (see, 40 C.F.R. part 261.24) which omits PAHs from the list of contaminants that may trigger RCRA's toxicity characteristic for hazardous waste; and 40 C.F.R. part 260, subpart D, which omits PAH-contaminated soils from RCRA's listed hazardous waste. The presence of these SVOCs may indicate the possibility of a past surface spill, site usage, or the leaching effect of asphalt compounds into the shallow soils. The vertical extent of the SVOC affected soils appear to be limited to the upper 1.5-foot interval, while the horizontal extent of the SVOC affected soils has not been determined.

The total metal results for the soil samples were all within the EPA SW-874 common soil range values with several exceptions. Mercury, cadmium, copper, and silver were detected

at slightly elevated concentrations above the common soil range values. These metal concentrations may be the result of these metals naturally occurring in the alluvium and bedrock and probably do not indicate the presence of hazardous wastes or other adverse environmental conditions. The EPA utilized the Toxicity Characteristic Leachate Procedure (TCLP) to determine if a substance will exhibit the characteristics of a hazardous waste. The TCLP procedure was developed to simulate the leaching of waste in an unsecured landfill. The EPA TCLP regulatory concentration for mercury is 0.2 ppm. A mercury value of 20 times the TCLP regulatory concentration of 0.2 ppm ($20 \times 0.2 \text{ ppm} = 4 \text{ ppm}$) is used as a general guideline to determine if a sample containing mercury could potentially exhibit the characteristics of a hazardous waste. The detected concentration of mercury (0.6 ppm) in soil boring IC-6 (14-15.5') is below the general guideline value of 4 ppm. Therefore, it is unlikely that mercury would exhibit the characteristics of a hazardous waste. Using the 20 times the TCLP regulatory concentration, it is also unlikely that the cadmium, copper, or silver concentrations identified in the soil samples would exhibit the characteristics of a hazardous waste.

5.2 Ground-Water Assessment

Soil borings IC-2 through IC-6 were completed as shallow alluvial ground-water monitor wells. However, less than one foot of water was present in ground-water monitoring wells IC-2 through IC-6 after a two week timeframe, therefore these monitor wells could not be sampled.

Seven Amoco ground-water monitoring wells (MW-1, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-13) were sampled on March 7 and March 8, 1995. PCE, TCE, and 1,2-DCA were detected in ground-water samples MW-1, MW-8, MW-9, MW-10, MW-12, and MW-13 above the respective CGWS. VOCs identified below the laboratory PQL include benzene, chloromethane, cis 1,2-DCE, 1,2-DCA, TCE, and acetone. PCE, TCE, 1,2-DCA,

benzene, chloromethane, and cis 1,2-DCE are compounds commonly used at service stations/automotive repair shops for metal degreasers and cleaning brake parts, and as a dry cleaning solvent at dry cleaning facilities. The highest VOC concentration was detected in onsite Amoco monitor well MW-8. The second highest VOC concentration was detected in hydraulically downgradient Amoco monitor well MW-13, and the third highest VOC concentration was detected in onsite Amoco monitor well MW-1. Elevated VOC concentrations were detected in hydraulically crossgradient Amoco monitor wells MW-9, MW-10, and MW-12.

No SVOCs were detected in the ground-water samples above the laboratory PQLs. TEPH was detected in ground-water sample MW-9 at a concentration of 0.5 ppm.

All ground-water samples were analyzed for the thirteen priority pollutant dissolved metals. The dissolved metal results are all within the CGWS with the exception of cadmium. Cadmium was detected in five ground-water samples (MW-8 through MW-11 and MW-13) at concentrations ranging from 0.007 ppm to 0.016 ppm. It should be noted that cadmium was detected in upgradient monitor well MW-11 at a concentration of 0.012 ppm, which may indicate that the cadmium concentrations are indicative of naturally occurring conditions in the bedrock ground water.

The field and analytical results indicate that the ground-water samples tested at the site are not significantly impacted by SVOCs, TEPH, or inorganic compounds (thirteen priority pollutant dissolved metals). However, the analytical results do indicate that ground-water samples collected from the Amoco property and hydraulically downgradient of the Amoco property have been impacted by VOCs.

The actual source of the VOCs present in the bedrock ground water is inconclusive. One possible source of the VOCs is the Amoco Station. This property has been used as a service

station by Amoco and Chevron since 1951. The types of VOCs detected in the ground water are typical of service station/automotive repair operations. It is possible that these VOCs are associated with a used waste oil tank release, which may be located on or near the Amoco Station property. The Amoco Station is a possible source of the VOCs identified in the bedrock ground water based only on the ground water data, which includes the previous and current calculated ground-water flow direction (southeast to northwest), and VOC concentrations detected in the Amoco monitor wells. As noted earlier, the highest PCE concentration was detected in onsite Amoco monitor well MW-8. The second highest PCE concentrations was detected in hydraulically downgradient Amoco monitor well MW-13, and the third highest VOC concentration was detected in onsite Amoco monitor well MW-1. Elevated VOC concentrations were also detected in hydraulically crossgradient Amoco monitor wells MW-9, MW-10, and MW-12. No VOCs were identified in upgradient monitor well MW-11. The PCE concentration contours presented on Figure 4 indicate the actual source and extent of the PCE cannot be determined based on the information obtained during this investigation. *max = 6774*

The VOCs present in the bedrock ground water represent chlorinated solvents with a specific gravity greater than 1.0 which means these VOCs are heavier than water (DNAPLs). Chlorinated solvents will typically migrate vertically through the alluvial material until they reach a relatively impermeable layer (bedrock). At the bedrock surface, these chlorinated solvents will migrate laterally due to gravity along the dip of the bedrock surface. This lateral migration can be with or against the local ground-water flow direction. Therefore, other possible sources for the VOCs detected in the bedrock ground water may include the Tuneshop, Star Dry Cleaners, and/or past service station facilities located on the northwest and southwest corners of the intersection. However, additional soil and ground-water data is necessary in the vicinity of the Belleview and Broadway intersection to determine the actual source of the VOCs detected in the bedrock ground water.

Based on the depth to bedrock ground water, the VOCs present in the bedrock formation aquifer should not pose a threat to worker health and safety in the project area. However, CDOT should consult with legal counsel prior to acquisition of properties along the proposed right-of-way to discuss any liabilities which may be associated with the VOCs present in the bedrock formation aquifer.

6.0 RECOMMENDATIONS

This PSI was performed in anticipation of construction activities within the study area in an effort to identify environmental conditions which may potentially impact such activities. IC recommends the following site specific actions for each corner of the Bellevue and Broadway intersection in anticipation of the planned CDOT construction project.

1
* Proposed soil borings BH-1 and IC-1 (northwest corner) were not completed since permission to enter that property could not be obtained by IC personnel. Therefore, no soil sample data are available for the northwest corner of the study area. These proposed soil borings should be completed to bedrock prior to initiation of the planned construction project. Selected soil samples should be analyzed for organic and inorganic parameters. Once these results are obtained, specific conclusions can be provided.

2
* The field and analytical results from soil borings IC-2 and IC-3 (northeast corner) indicate the soils tested at those locations have not been significantly affected by organic and inorganic compounds. However, proposed soil boring BH-2 (Tune Shop) could not be completed since site access was denied to IC personnel. Based on the previous and current site usage (service station/auto repair shop, etc), soil boring BH-2 should be completed to bedrock prior to initiation of the planned construction project. Selected soil samples should be analyzed for organic and inorganic parameters. Once these results are obtained, specific conclusions can be provided.

3
* The field and analytical results from soil borings BH-3 and IC-4 (southeast corner) indicate the soils tested at those locations have not been significantly affected by organic and inorganic compounds. However, no other soil borings

were completed along the proposed right-of-way between Amoco monitor wells MW-1, MW-8, and MW-10 where elevated levels of VOCs were detected in the bedrock ground water. Two to four additional soil borings should be completed to bedrock on the Amoco Station property. These soil borings should be placed between Amoco monitor wells MW-1, MW-8, and MW-10 to determine if the soils have been affected by organic or inorganic compounds.

4
* The field and analytical results from soil borings BH-4, BH-5, IC-5, and IC-6 (southwest corner) indicate the soils tested at those locations have not been significantly affected by organic and inorganic compounds with the exception of soil boring BH-5. Nine SVOCs were identified below the laboratory PQL and a slightly elevated cadmium concentration were identified in soil sample interval 0.3-1. The SVOCs identified are PAHs. PAH-contaminated soils are not RCRA hazardous wastes and can be disposed as a solid waste. Therefore, any SVOC affected soils excavated during the construction activities will have to be disposed as a solid waste at a suitable disposal facility. Two to four additional soil borings should be completed to bedrock in the vicinity of soil boring BH-5 to determine the horizontal and vertical extent of the SVOCs.

5
* Some of the Amoco ground-water monitoring wells and the IC ground-water monitoring wells will probably be destroyed by the proposed intersection expansion. Therefore, these monitor wells should be closed in accordance with the Office of the State Engineer, Water Well Construction and Pump Installation Rules and Regulations.

- * The Colorado Department of Public Health and Environment (CDPHE) may request CDOT or Amoco to replace any monitor wells which are anticipated to be destroyed during construction activities. A meeting with CDOT, IC, and CDPHE representatives should be conducted prior to the intersection expansion activities to discuss the possibility of replacement monitor wells.

- * Alluvial ground-water monitor wells IC-2 through IC-6 should be monitored on a monthly basis to determine if seasonal ground-water fluctuations may produce enough water in these monitor wells to warrant collection of ground-water samples. Ground-water samples collected from these monitor wells should be analyzed for VOCs and TEPH.

- * The five steel 55-gallon drums filled with soil cuttings should be sampled for disposal characterization. The soil cuttings present in the drums may be suitable for use at another location or may be disposed as a solid waste depending on the analytical results. The steel 55-gallon drum filled with purge water from the Amoco monitor wells is classified as hazardous waste and should be disposed at a hazardous waste disposal facility. IC will discuss the disposal options with CDOT prior to initiating disposal.

- * 9. If construction activities should proceed without completion of the above mentioned soil borings, a Health and Safety Plan (HASP) and a Excavation Soil Handling Plan (ESHP) should be developed for this project. Contractors involved with the construction and/or excavation activities should receive instructions concerning possible hazardous waste identification, potential health hazards, and reporting responsibilities in case hazardous wastes are encountered.